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Domestic Electrification.

IT is somewhat singular that, despite the torrent of eloquence, oral and written, that has been poured forth in recent years, and notwithstanding the statistical evidence which is abundantly available, on the subject of the domestic load, there are still some electricity supply managers who are more or less frankly sceptical as to the value and possible development of that outlet for electricity supply—a class of business which stands to benefit not only the suppliers of electricity, but also the manufacturers of almost every class of electrical machinery and apparatus, as well as the electrical contractors throughout the whole country, and the consumers themselves, who will certainly derive advantage from the increased use of electricity. Doubtless progress is slower in some towns than in others; "fashion" has great influence in every grade of society, and the popular taste differs from place to place—but of the eventual outcome we have no doubt whatever: the domestic load is bound to increase in importance almost without limit, and the far-sighted engineer-manager will both provide for it and foster its development. Only a few weeks ago Dr. S. L. Pearce pointed out that in the Manchester area the number of domestic consumers had quadrupled in the past five years; in the same time the sale of energy had doubled, and as there has been no such growth in the demand for industrial power during that period, it is a plausible inference that the doubling of the output was largely due to the increase in the domestic load. In the Tyneside area, the Newcastle-on-Tyne Electric Supply Co. connected 12,600 new consumers last year.

As an example of a successful domestic policy, we have obtained permission from Mr. A. E. McKenzie to explain the system which he has adopted in Wimbledon, where the load is rapidly increasing and extensions have become necessary, which are described on a later page. "Simplicity" and "Service" are the fundamental principles on which the system is built up. Every facility is afforded to the would-be consumer, to help him to secure connection and to ensure his subsequent satisfaction. To begin with, the tariff is cheap and simple: 3½d. for lighting, 1d. to ¾d. for cooking and heating, ½d. for water heating; and the application form is reduced almost to a formality. Apparatus of all kinds (except lighting) is provided on hire or hire-pur-

chase, and is installed by the Consumers' Department. Once apparatus is installed, it is not forgotten; the Department stands ready—even on Sundays—to attend to a faulty part or appliance at call, free of charge (except in the case of kettles), and no repairs are done on the consumer's premises, the faulty part being at once replaced by a sound one. Every effort is made to *please the consumer*—a phrase which ought to be inscribed in letters of gold on the heart of every official. Consequently dissatisfaction is rarely met with, and there is a steady increase in the load, without any sensational effort to develop it. As an instance of the flexibility of the service and the desire to please, we may cite the fact that no fewer than 13 types of cooker are hired-out by the Corporation. In this connection we may draw attention to the report of the E.D.A. Conference on hire and hire-purchase schemes which appears in this issue. Also, in view of the growing importance of the domestic load, we have thought it desirable to group together under a common head various classes of domestic appliances which have hitherto been noticed in our "New Devices," or "Notes" columns, to facilitate reference and to mark our appreciation of the potentialities of this thriving branch of the electrical industry.

British and Foreign Instruments.

THE reputation of British-made switchboard instruments for accuracy and reliability deservedly stands so high that an inquiry into their merits as compared with instruments of foreign manufacture might be thought superfluous; however, apparently the tradition that British instruments are inferior still lingers in some quarters, although it has long ceased to be well-founded. Possibly it is supported to some extent by the tendency, characteristic of the race, to adopt a simple and sober finish, free from the meretricious glitter that marks some foreign products; appearance counts for a good deal, though in fact it is the least important criterion of value. Thirty years ago, no doubt, certain foreign makes of instrument took the lead for accuracy and legibility, as well as other valuable qualities, but nowadays some of our instrument makers turn out work which for exquisite workmanship and technical excellence is unexcelled throughout the world.

However, the British Scientific Instrument Research Association thought there was sufficient vitality in the aforesaid tradition to justify a detailed investigation into its truth or falsity, which at the same time might lead to improvements in design; the inquiry has now been completed, and a summary of the very interesting report appears elsewhere in this issue. It is very satisfactory to learn, as a result of the examination of many makes, "that the instruments made by certain of the principal manufacturers in this country are not inferior to any comparable instruments of foreign manufacture; and that in what may be termed the general 'balance' of design some of the British instruments take a leading place."

A careful perusal of the report leaves the impression on one's mind that the examination has been conducted with a high degree of impartiality; credit is given where it is due, whether to British or foreign work, and adverse criticism is expressed with equal fairness. From some of the general statements which appear in the complete report, we gather that there is room for improvement in certain features, such as the choice of steel for the magnetic system, the mode of mounting the movement, the marking of the scales, and the design of the pointers; apparently no instrument combined all the best elements of design. Some of the suggested improvements would cost little or nothing to adopt. The fact that the "torque/weight" quotient varies over the wide range from 0.044 to 0.46 strikes us as remarkable, indicating fundamental divergencies in design.

The information contained in the report should prove of great value to British manufacturers, who will know how to apply it to advantage in their designs; and to the purchasers of switchboard instruments, whose confidence in the British product should be fortified by the results of the critical comparison with foreign instruments which have been placed on record.

A Business Book.

READERS who are prepared to give sympathetic study to a very human document dealing in an attractive manner with problems regarding business efficiency, management, control and cognate matters might spend a profitable evening with "Letters to an Absentee Director," which was issued a few months ago by Messrs. Pitman (5s.). We direct attention to this small book this week for two reasons. First, because in the early days of the New Year, as we try to draw aside the veil of the future with its unknown duties and responsibilities, there is greater susceptibility to suggestions and new ideas, in both of which the book abounds. Our second reason is that it is our sad duty to record elsewhere the death of the author—Mr. John Lee, C.B.E., M.A., M.Com.Sc.—who passed away suddenly a few days ago while returning from New York. A crowded life full of public and private service has come to an end all too soon, as it seems to us, but the influence of this truly remarkable man, like that of all who devote themselves with soberness and enthusiasm to the critical problems of their day, will live after him. The series of "Letters" was written originally for *The Times Trade Supplement*, signed by "The Junior" and addressed to "My Friend, E. A. Mellinger," and they are brought together in what is described as an unconventional book on the proper functions of boards of directors and their relation to executive management. The main theme running through all the notes is the problems of industry, emphasis being laid repeatedly upon the need for us all to remember that conditions have greatly changed in recent years. It is useless to attempt to face the new situations that are constantly confronting us unless we are prepared to change with the times. The book contains some frank remarks on a wide range of topics, including: directors and their training, associations in industry, profits, shilling shares, industrial combination, employé shareholding, leadership, executive control, trade unionism, American methods, works councils and reorganisation—all subjects of interest to-day.

Barton Power Station Libelled.

THE recent judgment of the Court of Appeal in the case of Farnworth *v.* Manchester Corporation (ELEC. REV., December 21st, 1928, p. 1068), throws back upon the latter the liability for damage resulting from the emission of sulphurous fumes from the chimneys of Barton power station; Lords Justices Scrutton and Sankey held that the Corporation had not proved that all reasonable precautions had been taken, and gave it a year to mitigate the nuisance. Lord Justice Lawrence dissented, and it is obvious that the question presents difficulties from the legal as well as the technical point of view. Alderman Dagnall, chairman of the Electricity Committee, in an interview stated that the Corporation had spent thousands on trying to find some way to prevent the nuisance, and might spend thousands more with no better result.

However that may be, the Corporation was justly aggrieved when the *Manchester Guardian* in a leaderette accused Barton of producing "a streaming banner of smoke as black as ever poured from a group of giant chimneys over a pastoral scene!" It was admitted in a later issue that a mistake had been made, for the smoke emitted from the Barton chimneys is hardly visible: the trouble is due not to "smoke," but to colourless fumes. Apparently the writer of the article had mistaken a local steel works for the Barton station.

Electricity Supply at Wimbledon.

The recent plant extensions at the Wimbledon Corporation Electricity Works have been rendered necessary by the growth of the domestic supply, in connection with which some excellent results are shown.

Plant Extensions.

FOR the year ended March, 1927, the maximum load on the electricity works of the Wimbledon Corporation was 7,450 kW. In the next year the maximum load recorded was 9,650 kW, representing an increase of about 30 per cent. The plant capacity at the end of the second period was 11,500 kW.

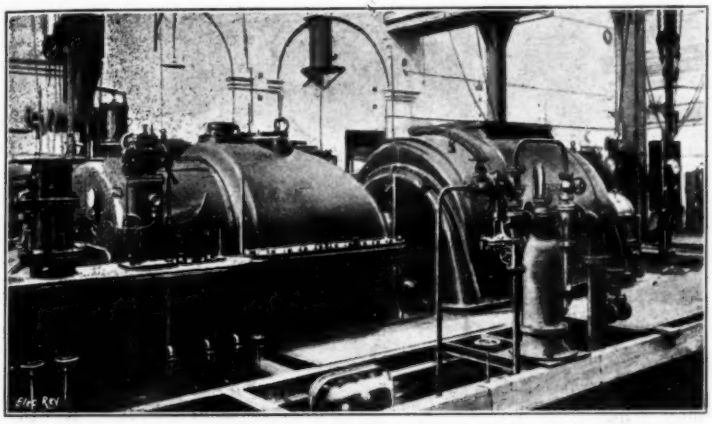


Fig. 1.—Turbo-alternator; Single-phase, 3,750 kW.

The above is sufficient explanation for the extensions which have recently been installed at the generating station. The new plant includes a 3,750-kW turbo-alternator set, fig. 1, with the necessary condensing plant and auxiliaries, and a 50,000-lb. boiler unit, fig. 2. The turbo set was supplied by the Metropolitan - Vickers Electrical Co., Ltd., and the boiler by Messrs. Babcock & Wilcox, Ltd. It is interesting to note that the generator, and the others of the same size in the station, are believed to be the largest single - phase machines in the country. The new alternator generates at 2,000 V, 50 cycles, and runs at 3,000 r.p.m. It is air-cooled on the enclosed system, the air itself being passed through water coolers. The turbine is of the impulse reaction type, and is designed for steam stop-valve conditions of 250 lb. per sq. in. and 650 deg. F. The steam consumption at 1¼ times full load, 0.8 p.f., is 11.64 lb. per kWh, and at full load 11.40 lb. per kWh. The condensing plant was supplied by Messrs. Hick, Hargreaves, Ltd.

The boiler unit consists of a B. & W. boiler, Green tri-tube economiser, B. & W. superheater, Sirocco induced-draught plant, and a steel chimney and the necessary bunkers and grates. The plant is designed to run continuously on a 25 per cent. overload. The working pressure and superheat temperature are 250 lb. per sq. in. and 700 deg. F. The total heating surface for the boiler, superheater and economiser is 17,463 sq. ft. An interesting feature in connection with the boiler equipment is that the proportion of the economiser heating surface to the boiler heating surface is considerably greater than that usually adopted, being of the order of 86 per cent., as against 60 per cent. The scheme, by reason of the lower exit gas temperature obtained, is believed to be a commercial proposition. The height of the chimney from the firing floor is 95 ft., and the makers guarantee an output from the boiler of 40,000 lb. per hour with natural draught only. The capacity of the bunkers feeding the boiler is 100 tons.

The chain-grate stokers employed with the boiler are of the "L" type, supplied by the Underfeed Stoker Co., Ltd., and designed for working on balanced draught. It required some confidence to put in such a plant for working on induced draught only, but the undertaking appears to have been rewarded by the satisfactory results obtained. The furnace arch is of the double-suspension "Liptak" type. The guaranteed efficiency of the boiler at normal full-load evaporation, based on gross calorific value for the fuel, is 82 per cent.

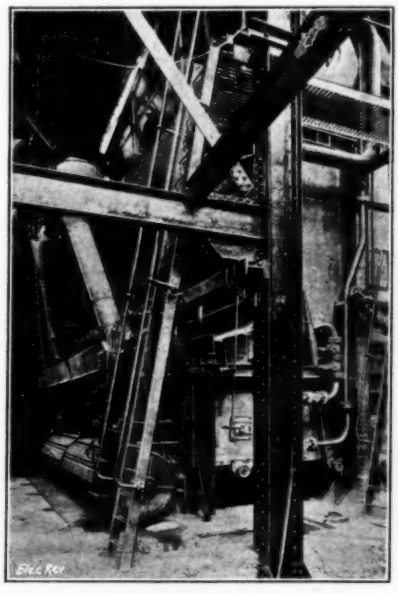


Fig. 2.—50,000-lb. Boiler Unit.

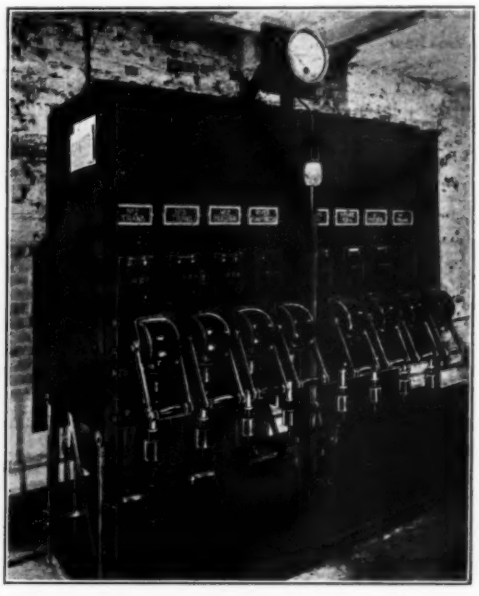


Fig. 3.—Standard Sub-station h.p. Switchgear.

It is interesting to note that a second boiler unit of the same size and type is to be installed, and that in order to accommodate the new plant, the existing boiler house had to be increased in height by about 45 ft. This has been effected by means of a steel structure sheeted with Trafford tiles. A new ash-handling plant installed by the Underfeed Stoker Co., works on the

water-sluice system. The ashes fall from the boiler hoppers into a trough, and a water stream carries them into a "whirlpool" from which the mixture is pumped to overhead ash bunkers by means of 24-h.p. electrically-driven Gwynn pumps against a head of 40 ft. The water is drained off and returned to the trough by gravity, and the ashes are dropped into trucks and taken away. The water stream flows at from 6 to 7 ft. per second. There are two ash bunkers, each with a capacity of 750 cu. ft.; these are of reinforced-concrete structure. In connection with the extensions, a new 22-in. pipe line to the river has been installed by the Brightside Engineering & Foundry Co., Ltd.

To meet the increased demand from the "outlying" districts, such as Malden, Raynes Park and Coombe, three 2,000-kVA transformers by the Metropolitan Vickers Co., Ltd., and one of 1,155 kVA capacity by the British Electric Transformer Co., Ltd., have recently been installed at the station. These are of the outdoor, oil-cooled type, and step up to 11,000 V for transmission. All transmission and distribution is single-phase.

About 20 transformer sub-stations have recently been added to the system, bringing the total up to about 100. It is considered advisable to put down new "subs" rather than increase the size of the feeders. A new sub-station at the works is fairly representative of the standard design adopted for the area. An interesting feature in connection with this is the switchgear, to which the undertaking contributed a good deal in the design. Fig. 3 shows the h.p. (2,000 V) equipment installed by the English Electric Co., Ltd. It is a simple angle-iron structure equipped with eight s.p. switches (earth return) in a total length of 6 ft. In the l.p. switchgear six units are accommodated in a total length of 2 ft. 3 in.

Domestic Supply Service.

In these days of rapid development of domestic electricity supply many undertakings must have found it necessary to reorganise their systems of accepting applications for supply, issuing appliances and materials, carrying out repairs, and so on, particularly the smaller undertakings in which, in the past, the mains or distribution departments have dealt with all work pertaining to the consumers—actual and prospective.

The Wimbledon electricity undertaking has produced some particularly interesting results in connection with its domestic supply service, and it is believed that the following notes on the system and methods adopted for dealing with the domestic supply will be of interest to many of our readers. It will be readily agreed that the results obtained are excellent for a comparatively small undertaking, especially so when it is noted that the showroom and administrative costs relative to the domestic service amount to something like £100 for the capital outlay, and £400 per annum working expenses.

During the first six months of 1928 the undertaking installed 240 cookers, 123 water heaters, 60 wash boilers, 340 irons and 250 kettles. Already this heating season over 500 radiators have been installed. The bulk of the apparatus is put out on hire, and, with the exception of lighting equipment, the department undertakes to hire out any obtainable class of domestic electrical apparatus. A considerable amount of hire-purchase business is also done by the undertaking, and in this connection well over 200 agreements for all sorts of appliances have been signed since March last.

In the light of the above statistics it is interesting to note the charges that are in vogue for domestic electricity supply in the area. There is no two-part tariff, and plain flat rates are charged for all services. For cooking and ordinary heating the supply is charged for at 1d. and ¾d. per kWh for the winter and summer quarters, respectively. Water-heating supply is rated

Fig. 4.—Cooking Demonstration Room.

Fig. 5.—Part of All-Electric Kitchen.

Date Received..... Application No.....

BOROUGH OF WIMBLEDON ELECTRICITY DEPARTMENT.

Application for a Supply of Electricity.

Full Name of Applicant. IN BLOCK LETTERS. (State, Mr. Mrs. or Miss)		For Official use only.
Address where supply is required.		Date Recon.....
Description of Premises.		L.....
Date supply required.		R.....
		P.....

PARTICULARS OF INSTALLATION.

(The supply is alternating, single phase, 50 periods per second, 220 volts.)

LIGHTING.		HEATING AND COOKING APPLIANCES, ETC.			MOTORS.	
No. of Lamps.	Size in Watts.	Actual No. of Appliances.	DESCRIPTION	Total Amperes at 220 Volts.	No.	Total H.P.
						P.T.O.

THE ABOVE INFORMATION MUST BE GIVEN BEFORE APPLICATIONS CAN BE ACCEPTED.

Fig. 6.—Application Card; Front.

at 0.5d. per unit, and lighting at 3½d. per unit. The main feature of the whole scheme is its simplicity. All the work, including meter fixing, is done by the consumers' department, which is entirely separate from the "mains." The relation between the two sections is similar to that usually observed between the distribution engineer and the contractors, and there is no friction whatever between the two branches of the undertaking. One important advantage of the consumers' work being kept strictly separate is that it avoids sending two or three lots of men to one house during the progress of any one job—a procedure which is often annoying to the consumer.

I/We hereby give notice to the Corporation of Wimbledon that I/we wish to have, and hereby agree with the Corporation to take, a supply of Electrical Energy at the premises mentioned hereon, and to pay for such supply at the rate or rates of charge for the time being charged by the Corporation therefor until such time as I/we may desire to discontinue the use of such supply, of which discontinuance I/we will give the Corporation 24 hours' notice in writing. I/We further agree to observe the Terms and Conditions of Supply made by the Corporation from time to time, all of which shall be deemed to be incorporated in and form part of this agreement.

Signature of Applicant	
Occupation	
Present Address	
Previous Address	
Date of Application	
Name and Address of Wiring Contractor	

P.T.O.

Fig. 7.—Application Card; Back.

Little is done in the way of propaganda, and for new business the undertaking relies chiefly on its attractive charges and its simple and straightforward methods. Considerable business, however, is obtained as the result of cooking demonstrations, one of which is given every week in a specially equipped room, fig. 4.

A very interesting point to the credit of the undertaking is the real and successful effort that has been made to do away with the usual long and irksome application form. Figs. 6 and 7 show the two sides of a card which, filled in, is accepted as an orthodox application. The terms and conditions of supply are contained separately in a small pamphlet.

At the commencement of a new job a simple voucher is issued to the foreman wireman. This is in three portions, one in the form of instructions to the foreman, a second for giving notice to the office of the completion of the work, and a small "chit" advising the mains department that the job is ready for testing. There are 7 wiremen and their mates constantly employed on new work. In connection with the hiring out contracts for cookers and wash boilers, the wiring is installed free up to 30 ft.

No doubt the most vital point in connection with any maintenance scheme is that of carrying out repairs with a minimum of delay, and in this matter the work of the department shows great initiative and foresight. Practically all the repair work is in connection with the cooking equipment, and 90 per cent. of the cooker repairs are on the boiling plates. All ordinary repairs are carried out on the same day as the notification of the trouble is received—up to a reasonable time, of course. Less than half a dozen cookers are returned per annum through dissatisfaction.

There are two separate gangs of repairs men—one for the heavier apparatus, cookers, wash-boilers and water heaters—and one for radiators, kettles and irons. A considerable number of the faults are reported on the telephone, and the operator books all the calls and endeavours—usually successfully—to ascertain what part of the apparatus has failed. The bulk of the remaining jobs are notified through the post. The repairs men ring up the office from various points in the area at stated times during the day, and receive instructions concerning the latest notifications of troubles in their allotted areas. Every repair job is entered on a voucher in triplicate, two copies of which are issued to the repairs foreman. These are returned to the office on completion of the work for the necessary booking of the time, materials, and so on.

With the exception of the kettles, the cost of repairs to the appliances is borne by the undertaking. All the kettles hired out by the department are fitted with safety devices, and it is found that 9 out of 10 failures are brought about by negligence. In the main repair workshop is up-to-date equipment for dealing with the returned kettles. These appliances are all put through a "mass-production" process, including re-polishing outside and re-tinning inside, and it is interesting to note that the repairs bill amounts to about 2s. or 3s. per kettle, against about 12s. charged by the makers.

A careful record of all the repair work carried out on the large appliances is made in the office, and the record is so analysed as to show the maintenance costs over given periods for the different makes and classes of apparatus installed, and the various parts of the appliances. There are at present 13 different types of cookers handled by the Corporation. At the end of September last, 1,897 cookers were connected to the mains, and the average number in use for the previous

VOUCHER NO.....

ORDER FOR APPLIANCES ON HIRE.

TO THE CORPORATION OF WIMBLEDON, ELECTRICITY DEPARTMENT.

Please supply the following Appliances on hire for use at:

The minimum hiring period to be .....years. Subject to fair usage, such appliance/s, (except kettle/s) to be maintained free of cost to me:—

APPLIANCE	RENTAL

SIGNATURE OF HIRER:

DATE.....192 | ORDER BOOKED BY:

Fig. 8.—Order Card; Large Appliances.

12 months was 1,798. The average maintenance cost per cooker for that period was 15s. 4d.; for the previous year the figure was 19s. 8d.; while for the year ended September, 1926, the amount spent per cooker was 21s. 9d. It is particularly interesting to note that the drop is attributed, not to the increase in the number of cookers installed, but to the change-over which the undertaking is effecting to closed-type boiling plates. Another point of interest is that the make of boiling plate adopted is not necessarily the same as that of the cooker. An important feature in connection with the record keeping of the department is the entry of all the particulars concerning every appliance during its life

in a "history" book; separate books are kept for the large and small appliances.

There are several repair shops and stores situated in various parts of the area, and when the men are advised of a job, they go and see what is wanted, if necessary, and then journey to the nearest store to get the necessary spare parts. An important point is that the men are not allowed to attempt to carry out the actual repair work on the consumer's premises, but merely change the part that is faulty—boiling plate, oven element, and so on.

With regard to the ordering of apparatus for hire by consumers, figs. 8 and 9 show two cards which, filled in, are accepted by the undertaking as official orders for the large and small appliances, respectively. The large-appliance cards are filed away in road order, and in that way serve as a useful record. A time-saving scheme is the issue of vouchers in triplicate for the small appliances, one copy being given to the storekeeper as his order for the issue of the materials.

The latest development of the department is the equipping of 200 houses on a new estate at Malden. These are all-electric, except for one coal fire. A 10-gal. "Inventum" water heater is installed in the bathroom, and a similar 1½-gal. water heater is fixed in the kitchen, fig. 5, as part of the cooker equipment; the hire charge for the small water heater is included with that of the cooker.

One of the simple details to which attention has been given by the department in its vigorous policy of "pleasing the consumer," is the provision with each cooker of a standard control board. In addition to the necessary equipment for the cooker itself, this board, fig. 5, is fitted with a multiple 10-A plug, which amounts actually to one or more power points ready for the use of other domestic appliances. This has proved to be a considerable saving to both consumer and department, and a valuable business-getting scheme.

Another point designed to please the consumer is an arrangement for giving attention to faulty apparatus on Sundays and holidays, when there is a stand-by man at the office during cooking hours.

In conclusion, it may be as well to stress the fact that the department makes a particular point of not making exaggerated claims for the electrical apparatus, and its policy of "no fairy tales" has proved, beyond doubt, the correct one.

We have perused recent annual accounts of the undertaking, and they afford ample proof that the bold policy of developing the domestic load adopted at Wimbledon has been fully justified.

We are indebted to Mr. A. E. McKenzie, M.I.E.E., M.I.Mech.E., chief engineer and manager, for permission to publish the above details, and to Messrs. W. J. Oswald, A.M.I.E.E., chief assistant engineer, and B. A. Larney, commercial assistant, who is directly responsible to the chief engineer and manager for the development of the domestic supply service, for their assistance in the collection of the information.

POST CARD.

1d STAMP

Please send me an Electric Iron on hire (with 2-way connector)* at a rental of {1/- per quarter, / 1/3 per quarter,* the minimum hiring period to be two years.

Name.....

Address.....

.....

Date.....

* Please strike out if not required.

To The Chief Engineer & Manager,
Corporation Electricity Works,
Durnsford Road,
Wimbledon,
S.W 19.

Fig. 9.—Order Card; Small Appliances.

Electrical Development in British Columbia.

The Work of the Electrical Service League.

By FREDERICK H. FULLERTON.

SOLUTION of many of the problems which confront the electrical industry in the United States and Canada has been found in the organisation of Electrical Service Leagues throughout various parts of the territory of these two countries. The Electrical Service Leagues are organised under the auspices of the Society for Electrical Development, which has its headquarters in the United States, but the leagues themselves are particularly active in both eastern and western Canada. It is an interesting fact that in the actual number of private houses which have been granted "Red Seal" certificates, which are the approved symbols of correct electric wiring, the cities of Toronto and Vancouver are to be found within the first three places in the list of all the cities in which Electrical Service League work is being carried on throughout the North American continent.

There are now in the city of Vancouver a total of 1,258 "Red Seal" homes. These figures are in accordance with the publication of regulations by the Society for Electrical Development, in which each suite in Red Seal apartment blocks is counted as a home.

During the past year the Electrical Service League of British Columbia has carried on considerable educational work along the lines of better wiring and illumination in offices, stores and factories. Owing to lack of capital, it was found impossible to employ salesmen to follow up the work which was done by correspondence and advertising, but as the League is composed of electrical contractors, retailers, manufacturers, and the central station, the salesmen from several of these concerns co-operated with the League in following up the circulars which were sent out, with the result that considerable business was secured. The supply undertaking, the B.C. Electric Railway Co., accepts the responsibility for the major portion of the expense of operation, and supplies an office at its headquarters for the secretary of the League. The manufac-

turers then assume the next largest proportion of the expense, while the balance of the expenses involved in connection with the operations is paid for by the contractors and the electrical dealers in proportion to the connection of the League with their particular business.

The programme of publicity and propaganda which was carried out by the Vancouver organisation during 1928 included the issuing of 15,000 circulars. These circulars were mailed to factories, stores and offices throughout the Greater Vancouver area, and offered free of charge the services of the illumination engineer of the League for the purpose of making a survey of the lighting equipment of the office, factory or store to which the communication was addressed.

In addition to the actual circulars which were sent out, a certain amount of literature is issued by the Electrical Service League. This is sent to every permit taker in the city of Vancouver or in the surrounding municipalities of South Vancouver, Point Grey and Burnaby, and in the city of North Vancouver and the North Vancouver municipal district. This literature is also sent to the associations of the various industries and to the general contractors, electrical contractors, master builders and architects throughout the province of British Columbia, and all members of the Property Owners' Association and the Real Estate Exchange. The figures for 1928 have not yet been completed, but it is interesting to note that during the year 1927 the League sent out over 16,958 circular letters and well over 10,000 pieces of printed matter.

It is impossible to arrive at definite figures as to the results obtained from the general propaganda. Ninety-five per cent. of the wiring of residences and Red Seal homes was done by residence wiring contractors who are not members of the League, but from the number of inquiries and calls received during the year, the League is proving that the general lighting propaganda is achieving excellent results. Data were supplied and electrical lay-outs made for 83 residences. Lay-outs, advice, and specifications were supplied to 64 stores in Vancouver, South Vancouver, and Point Grey districts. The League dealt with a total of 17 apartment houses during the year. While it was only possible to grant certificates to eleven of these, the wiring of the others was approved, but owing to no electric ranges being installed, certificates could not be awarded. The League also laid out and revised lighting specifications for seventeen offices, two Vancouver docks, three hotels, four garages and petrol stations, three theatres, three restaurants and cafés, five stores, a recreation park, two warehouses, four churches, two auditoriums, and the Vancouver public library and museum.

In the school-lighting campaign circulars were sent to all school boards and school trustees on the Lower Mainland. The League collaborated with the trustees of Burnaby and South Vancouver in the new schools erected by them, and both of these municipalities are carrying out suggestions made and are installing modern lighting in the schools. In the matter of street lighting, the League has always supported the City Electrical Department in its effort to install new standards in the principal business and residential streets with great success.

In addition to results from the intensive campaigns, inquiries were received all through the year; the League received requests from 64 stores for advice on revising the existing lighting equipment or planning new systems. It is estimated that the store and factory lighting campaign in the autumn of 1926 and spring of 1927 resulted in some $20,000 worth of business being secured for the industry. In 1927 the League also received requests from 21 factories, and the illumination engineer of the League revised or laid out lighting for them.

The directors of the League felt that such success had been obtained in the store and factory lighting campaign that an effort should be made to procure better illumination in the offices of Vancouver. In 1927 a campaign was therefore made as an experiment, and a total of 6,961 office lighting circulars were issued in a series of three. The campaign, while disappointing through not being followed up, showed that there is a large field open for canvass, and it is the intention of the League to continue the work this year.

Owing to the number of new apartment houses being erected in Vancouver, the League felt it was opportune to press on the owners of the old apartment houses the necessity for bringing their wiring up to modern requirements. A total of 1,730 circulars were sent out to apartment house owners and to tenants. This work was not followed up by a personal canvass, but a number of the large apartment houses have remodelled, or are remodelling their wiring, and there is no question that a greater proportion of the others will very shortly follow suit.

A considerable portion of the year was devoted to promoting better wiring in the homes of Vancouver and district through Red Seal literature. It is gratifying to note that, while considerable success was secured with this campaign in 1926, the results were more than trebled in 1927. The method of procedure was as follows:—1. Circular to all permit takers on general residential lighting. 2. Circular on Red Seal wiring, enclosing Red Seal pamphlet. 3. Circular offering the service of the League to lay out lighting or check plans, and enclosing specifications. 4. Arrangements with Inspection Departments of Point Grey and Vancouver for notifications when applications for electrical permits were made for new homes. 5. Inspection of all applications for Red Seal wiring.

During 1927 the League inspected a total of 848 houses, and for the purpose of record divided them into six classes. In Vancouver and surrounding districts there were a total of 3,322 new houses built. Of these, 15 per cent. were for small additions, and 20 per cent. for four-room bungalows and under, leaving a total of 2,160 houses over six rooms; the League actually got into touch with 1,940 of these. From the circulars sent out, 848 applications were received and houses inspected during the year, while 55 applications were pending at the end of 1927. During the year the League granted 283 residential certificates and certificates to eleven apartment houses and two "duplex" houses. These apartment houses comprised 164 suites and contained a total of 3,440 outlets. Altogether in 1927 there were 449 units awarded Red Seal certificates in Vancouver and district. In Greater Vancouver at the end of the year there were 614 Red Seal homes and apartments.

The League approached the Architectural Institute in British Columbia to endorse the Red Seal specifications, and while official endorsement has not yet been received, all architects are practically meeting the League in any new building which they design. The Small House Service Bureau, subsidiary of the Architectural Institute, through its secretary, Mr. E. W. Turnquist, has worked in close co-operation with the League in all plans sold through its service in British Columbia.

Electric signs have also been receiving attention. During the year there were installed in Vancouver 54 new electric signs. These signs required 13,633 outlets, and with the necessary lamps and renewals made an estimated total sale of 26,000 lamps during the year.

The work of the League in Vancouver and district is undoubtedly arousing more interest each year in the greater use of electricity, in better wiring, and in the use of electrical appliances. 1927 has shown the greatest results the League has yet obtained, so far as residential wiring and lighting is concerned, and it can be safely said that the work of the League in this connection has increased the wiring of Vancouver homes by at least 50 per cent.

The president of the League during the current year is Mr. George Kidd, president of the British Columbia Electric Railway Co.

Modern Stone Quarry Equipment.

An electrical installation which provides convincing evidence of the large output and saving of labour made possible by the use of modern machinery.

WITH the gradual growth of the City of Edinburgh and the expansion of small towns within the County of Midlothian, many of the main arteries to the outlying districts have been reconstructed on modern lines. That work, coupled with increased road repairs consequent upon the ever-increasing traffic, called for a greater output of stone from the quarries of the Midlothian County Council and, as the machinery with which they were originally equipped was not of sufficient capacity to meet the increased demand, it has been reorganised and extended considerably, the two gas engines of 80 and 40 h.p. with which the plant was originally driven having now been discarded and electric induction motors installed throughout.

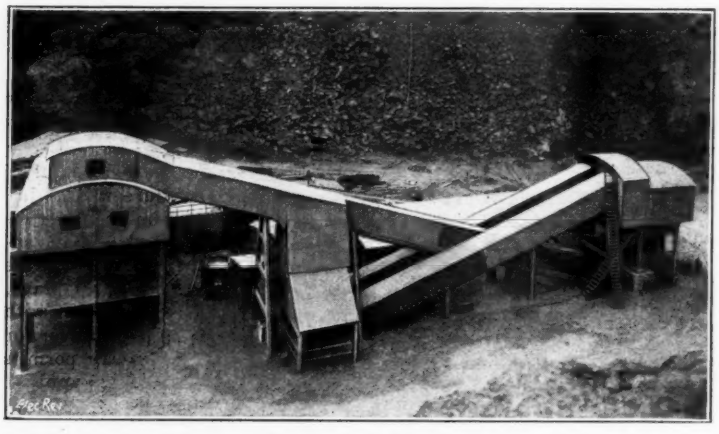


Fig. 1.—General View of Blackford Quarry Plant.

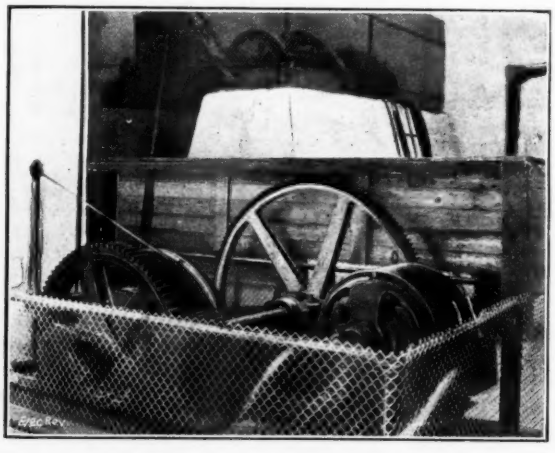


Fig. 2.—Rope Haulage and Shaker Feed Driving Motors.

A bulk supply of electricity is purchased from the Edinburgh Corporation at 6,600 volts, 3-phase, 50 cycles, a static sub-station within the quarry reducing the pressure to 400 volts by means of a 400-kVA transformer which was manufactured by Messrs. Bruce Peebles & Co., Ltd., to the order of the Edinburgh Corporation. The contract for the motors was placed with the same Company through its agents, Messrs. Mitchell Graham & Son, Ltd., who carried out the whole of the electrical installation work. The complete quarry plant was designed and supplied by Messrs. H. R. Marsden, Ltd.

The first operation in quarrying road material is the breaking up of rock by drilling and blasting, which is then roughly separated by hand and graded into two sizes of over and under 5 in. and transferred to light narrow-gauge rail wagons; these transport it to the inclined endless-rope haulage road serving the feeding platform, which is driven by a 16-b.h.p., 712-r.p.m. protected squirrel-cage motor (fig. 2). Two hoppers are situated at the side of the track on the feeding platform, and when the wagons come abreast of these their contents are tipped into them, the large material going to the primary crusher and the small to the shaker feed. The empty wagons are then run on to return rails and automatically return to the quarry face.

The reciprocating shaker, its function being to receive the small material in bulk from the wagons and evenly feed it to No. 1 conveyor, is driven by a 10-b.h.p., 945-r.p.m. enclosed-ventilated slip-ring motor, the whole equipment being mounted on an elevated platform in the same house as that in which the haulage gear is installed (fig. 2). The Blake-Marsden 36 in. by 24 in. F-type primary crusher has jaws and side plates constructed of manganese steel, and it is capable of reducing the material to 5 in. at the rate of 85 tons per hour when running at a speed of 300 r.p.m. Two heavy flywheels ensure steady operation of the crusher, which is driven by a Peebles 85-b.h.p., 972-r.p.m. enclosed-ventilated slip-ring motor similar to that illustrated in fig. 3. The No. 1 belt conveyor collects the output of the primary crusher and shaker feed and transports it to the secondary crushing plant.

In order to prevent "tramp iron" reaching the secondary crushers, a "high-duty" magnetic pulley has been installed in place of the ordinary conveyor head pulley; it is energised at 220 volts by a Peebles 3.5-kW squirrel-cage induction motor-generator set, which is situated in the same house as the motor (fig. 3) that operates No. 1 conveyor and the four Blake-Marsden 20 in. by 12 in. "X"-type stone breakers which form the secondary crushing plant, each machine having an out-

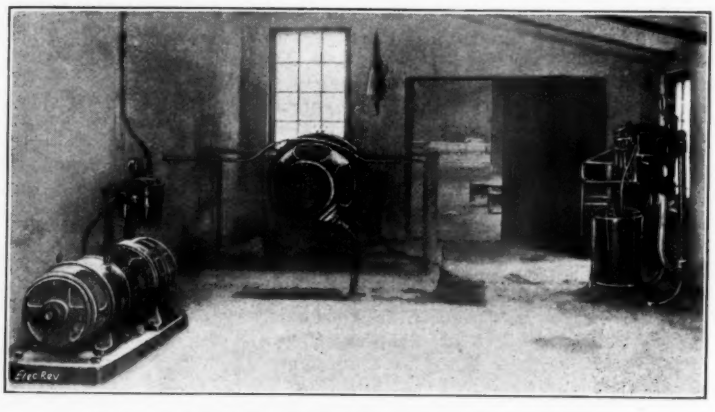


Fig. 3.—Crushing Plant Motor and Motor-Generator.

put of 12 tons per hour, reducing the material to 2½ in. and under. The output from each pair is collected by two belt conveyors (Nos. 2 and 3), each 18 in. wide, with 105-ft. centres, and transported to the chippings plant, consisting of two cylindrical primary screens and two crushers. Each screen is 4 ft. in diameter and 15 ft. 3 in. in length, made up of several sections perforated with different sizes of holes for suitably grading the stone. The graded material automatically passes through collecting hoppers into the crushers, the rejects being fed to a 30 in. by 6 in. Blake-Marsden granulator and the smaller material either to a disk crusher, or to No. 4 conveyor, or both as required. The granulator when set to crush to 1 in. and under has an output of approximately 10 tons per hour when running at 280 r.p.m. The complete chippings plant and Nos. 2 and 3 conveyors are driven by an 85-b.h.p. motor similar to than shown in fig. 3.

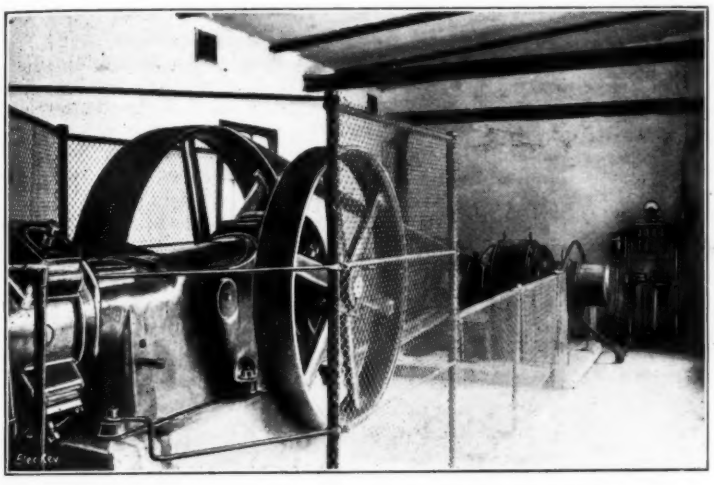


Fig. 4.—Air Compressor and its Driving Motor.

The crushed material from both machines is collected by the conveyor just mentioned, which is 24 in. wide with 170-ft. centres, and carried to the feed hopper situated over the main grading and tar macadam plant. On reaching the former, the material passes through two cylindrical screens, each 4 ft. in diameter and 35½ ft. in length. The screens and the No. 4 conveyor are driven by a 50-b.h.p., 967-r.p.m. enclosed-ventilated slip-ring motor. The screens are above two ferro-concrete storage bunkers of a total capacity of 800 tons, divided into compartments so that any size of material can thus be transferred direct to wagons.

The tar macadam plant is fed by means of belt conveyors running longitudinally under each bunker. It consists of two Blake-Marsden mixers of the double-paddle type, each with eight paddle arms, at a suitable height over the roadway, so that the "batches" may be dropped straight into wagons. This plant and the machine tools in the fitting shop are driven by a 25-b.h.p., 965-r.p.m. enclosed-ventilated slip-ring motor, and fig. 4 illustrates a 60-b.h.p., 970-r.p.m. enclosed-ventilated slip-ring motor driving an Ingersoll-Rand air compressor for operating the rock drills.

A central electricity distribution station situated adjacent to the transformer house contains an oil-immersed unit-type Geo. Ellison distribution switchboard to which the low-voltage side of the transformer is directly connected. As will be seen from fig. 5, the switchboard controls the incoming supply from the transformer, and the three smaller switches the feeder circuits. The former panel consists of a 450-amp. triple-pole, oil-immersed circuit breaker provided with three overload releases, time lags, no-voltage release, ammeter, and leakage indicator. The three outgoing feeders are each controlled by a 200-amp., triple-pole, oil-immersed circuit breaker surmounted by an ammeter and fitted with three overload and one no-voltage releases with time lags. The overload releases are provided with padlocked dust-proof covers, whilst 3-core, paper-insulated, lead-covered and wire-armoured cable is used throughout, all switchboards and control gear being provided with the necessary cable boxes for its accommodation. The feeder cables leading from the distribution station are laid in trenches where necessary, and cleated on wood grounds attached to the walls of the buildings where convenient. The cables terminate in unit mining-type distribution panels, each of which consists of three single-pole, Home Office pattern fuses with "unbreakable" handles, triple-pole, quick-break isolating switches, and busbar chamber, the fuses and switches being interlocked so that the doors cannot be opened when the switches are closed. The motor circuits are controlled by triple-pole, oil-immersed circuit breakers mechanically interlocked with oil-cooled rotor starters. Spare "ways" have been left on the boards where possible extensions are contemplated, and the distribution boards are arranged to facilitate future extensions. All the switchgear is electrically bonded to the earth system, and the general system of distribution has been to group the motors in sections and to feed each section with one cable, this arrangement being the most convenient in view of the lay-out of the buildings. All the motors are of Peebles manufacture and, with their control gear, are housed in separate chambers, so as to protect them from stone dust, driving through the walls by means of belts. The complete electrical installation complies fully with the Coal Mines Regulations.

Fig. 5.—Central Distribution Switchboard.

Wiring the Homes of the United States.

According to estimates prepared by the Statistical Department of the National Electric Light Association, U.S.A., 842,000 new homes and farms were wired for electricity during the first nine months of 1928. If the last quarter of the year shows the same increase as the third quarter, the number of wired homes added during the year will approximate to 1,150,000, and the grand total on December 31st will exceed 19 millions.

Repairs Investigations.

Details of a successful scheme adopted for the collaboration of the repairs and designs departments of a manufacturing works.

By STUART F. PHILPOTT.

THE potentialities of the repairs department as an aid to the design office are very often neglected in engineering works in this country, repairs being considered rather as a necessary evil than anything else. The criterion of an article's worth is its performance *in service*, and whilst laboratory tests are very essential in the early stages of a product, it is only from machines returned for repair that its performance under actual working conditions can be gauged; but unless some scheme of collaboration exists between the two departments, much valuable information concerning the article is bound to be lost.

REPAIRS INVESTIGATION REPORT A. B. & Co., Ltd.

MACHINE Type 63 Fan. DATE 6/9/28 REF. No. 1017
VOLTS 220 AMPS. ·3 H.P. 12" 1550 r.p.m.
SERIAL No. 33777 DATE OF MANF. 5/28.

CUSTOMER'S NAME A. E. J.
ADDRESS M — St L
INSTRUCTIONS Will not run Faulty.
Overhaul + make as new.
TESTS AS RECEIVED No performance. S.C.

	TYPE	
MOTOR		
ARMATURE	Q	O.K.
FIELDS		O.K.
COMMUTATOR	R.	High micas
BRUSHES	R	Burnt due to sparking
FRAME		O.K.
NOISE		
RESISTANCE		
ELEMENT	63/220.	O.K.
SWITCH	S.	Contact arm loose and making faulty contact. Bad riveting
BLADES	12"	O.K.
CASING		O.K.
WORK TO BE DONE		Skim comm. Overhaul. Fit latest pattern switch arm.

TESTED BY K.D. REPORT CHKD. BY [illegible] DATE 7.9.28.

FREE REPAIR

Fig. 1.—Examination and Test Report.

Of course, major troubles and interesting defects get more or less reported to the design and research departments of the works, but usually no attempt is made to keep these sections *systematically* informed of the general run of repairs being executed, nor does the design office keep the repairs staff informed of progress and alteration in design of the various products.

The scheme outlined here was evolved to overcome this difficulty; it has been very successful in operation, and is eminently suitable for works manufacturing small apparatus, such as fractional-horse-power motors, fans, telephone and radio equipment, domestic appliances, and so on.

Each machine or piece of apparatus coming in for repair is examined and tested, and a report is made out on the form shown in fig. 1, giving the date of manufacture, faults, and other details. The machine is then labelled to correspond with the number on the report form and passed on for repair, unless it has an unusual or special fault, when it is put aside for further investigation. The report is passed to the repairs technical department for examination.

Reports on apparatus having a date of manufacture over a predetermined limit, *e.g.*, eighteen months, are disregarded, as a fault which takes that time to develop is not considered serious. The remaining reports are carefully examined, checked where necessary, and the faults are tabulated on a special form, as shown in fig. 2, all the essential details being briefly noted.

Production arrangements are such that machines having any special feature, for instance, a new kind of insulating material, are marked with a suitable sign, usually a letter. These details are, of course, noted on the report sheet, and go into the summarised report, so it is easy for the designs staff to determine from the latter the result of any change in material or in design. It is, of course, up to the designs office to keep the repairs people acquainted with all changes.

In addition to the report going through in the ordinary manner, any machine or apparatus returned for repair having special trouble, or a modification mark of recent issue, is held up pending decision as to whether laboratory examination is desirable or not. The personnel required depends on the class and amount of repairs handled. For a moderate-sized plant, one or two intelligent youths on examining and reporting, and one senior technical man examining reports and investigating troubles on the spot should be sufficient.

REPAIRS WEEKLY SUMMARY W.E. 3/9/28 PAGE 3
TYPE 63 FANS

No. REPAIRED DURING WEEK 21 No. FAULTY 10

DETAILS OF FAULTY M/C's

6 Armature S.C. --- 8/27. 8/27A 8/27A 9/27A 12/27 1/28

All Shorts were in windings, commutators O.K.

1 Armature Earthed 2/28

Micanite end ring broken down. Forwarded to Investigation Dept for further examination.

2 Switch Contact Arm loose on boss causing open Circuit 3/28 5/28

Arm was loose due to bad riveting. Machines fitted with latest type screwed boss in accordance with instructions.

The Commutator micas had risen in the 5/28 machine (Type R)

1-Bad Sparking 4/28

High micas and loose comm. bars. Type R

Fig. 2.—Summarised Fault Reports.

The success of the scheme depends on the care and intelligence used in making the reports, and on the hand-in-hand working of the departments.

Fault Indication.

A scheme has been adopted at the main Manchester City sub-station for indicating on a central board faults on the station plant and feeders.

By A. PHILIP, B.Sc., A.M.I.E.E.

MODERN switchgear and protective appliances have been brought to such an efficient state that any faults which may occur on a supply system are cleared quickly, and in many cases with practically no general disturbance, so that in large sub-stations with many important connections it is essential that any fault should at once be brought to notice in order that steps may be taken to resume an interrupted supply immediately, or to prevent any further spreading of trouble which might be caused, for example, by the failure of one supply overloading others in parallel.

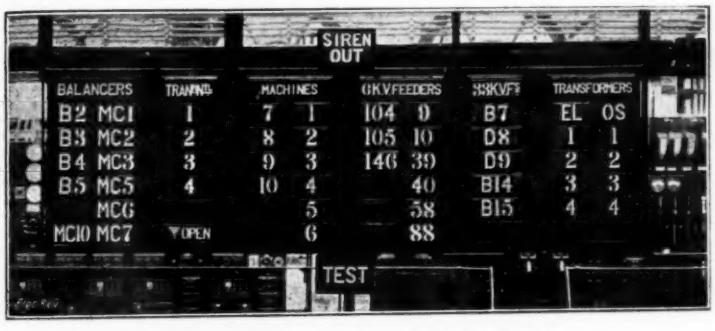


Fig. 1.—General View of Indicator Board.

In the case of the main sub-station feeding the Manchester city network, the types of plant involved cover a wide ground, including both incoming and outgoing high-pressure feeders, transformers, d.c. power and lighting supplies, and traction feeders, and the importance of the station is indicated by the fact that the winter load attains a figure of some 16,000 kW for the d.c. output alone. In the event of any local fault or of a system disturbance occurring, it is very desirable that the charge engineer should be at once acquainted with the position, so far as the plant under his care and the feeders connected to the station are concerned, and with this object in view an alarm signal system has been designed and installed, so that any fault occurring on the main items of plant can be at once signalled and an alarm sounded.

The plant covered by the indicator system falls into the following groups: (1) 33,000-V feeders; (2) 6,600 V feeders; (3) 33,000/6,600-V transformers; and (4) converting plant.

In the case of groups 1, 2, and 4 an indication is given if the switch for the item concerned is tripped automatically, whatever the cause, but in the case of the transformers, if an earth fault occurs it is signalled separately. In addition, indication is given of fault current flowing in the neutral earthing connection of the transformers, and of the opening of this connection if such fault current is maintained. the transformers being connected delta-star. The alarm is also given if large out-of-balance currents flow on the d.c. side.

The general scheme of operation is that for each piece of equipment an indicator relay, when energised simultaneously with the tripping of the oil switch, or with the occurrence of the incident to be signalled, lights a lamp behind a stencilled plate on an indicator board, and at the same time an audible warning is given by means of a motor-driven siren. Fig. 1 is a general view of the indicator board mounted in position, from which it will be seen that, in addition to the individual signs, there are group signs at the head of each section. A method of illuminating the group title would be, of course, to have lamps in parallel with the item lamps, but owing to the large number of lamps required, it was decided to illuminate the group signs by means of auxiliary relays energised by current flowing in the common return lead from each group of lamps. The auxiliary relays are shown in fig. 2. Additional contacts are fitted to these relays for the purpose of energising the siren.

A typical schematic diagram of connections for the oil switch indicators is given in fig. 3. It will be noticed that the relay winding is inserted in a branch of the oil-switch trip circuit which is not energised during manual opening of the switch. The type of indicator relay used for the great majority of circuits is shown in fig. 4. These relays are of the attracted-armature pattern, with a locking device and an indicator flag. Resetting the relay is accomplished by means of a spring-loaded push rod, which unlocks the armature. A small window is cut in the centre of the front cover, in which a flag appears when the relay operates.

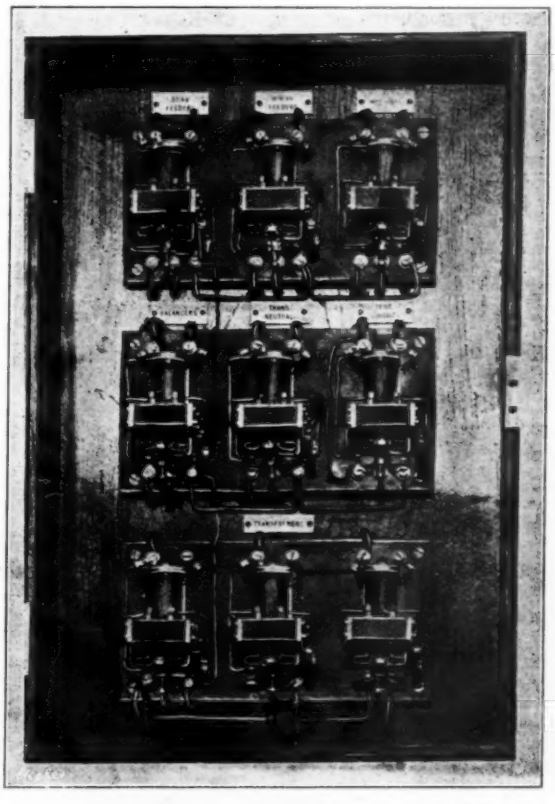


Fig. 2.—Auxiliary Relays for Group Titles.

The signals headed "transformers, earth leakage," shown in fig. 1, are fed by means of relays supplied from current transformers arranged in the earthing

connections of the transformer cases, the cases being elsewhere insulated from earth, so that any earth-fault current has to flow by this path. The current transformers are ring-type in order that the earthing connection may be maintained as a continuous straight copper bar.

The out-of-balance indicators are operated by means of centre-zero moving-coil relays fed by shunts in the middle wire of the d.c. supplies. These relays are scaled in amperes and can be set to any desired value, but they have, of course, no tripping function. They are provided with hold-on coils and are reset by

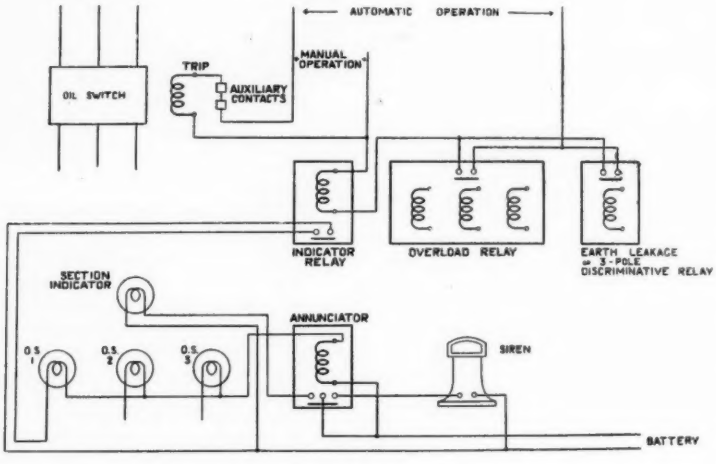


Fig. 3.—Connections for Oil-switch Indicator.

means of a common push-button. No large out-of-balance on any of the machines thus occurs unnoticed.

A feature of the equipment is that, after the alarm has been given, the siren can be silenced by means of a throw-over switch, leaving the indicating lamps lighted. Thus, the extent and nature of any disturbance are left on record until all concerned have become acquainted with the facts. This information would not be available visually after the indicator relays had been reset. The throw-over switch lights an addiitonal signal, indicating that the siren has been cut out of circuit.

Signals on somewhat similar lines are also installed in the undertaking's generating stations, but the equipment described is unique in covering such a large amount of plant by one centralised indicator. With the exception of the out-of-balance relays, the whole of the equipment has been constructed in the department's workshops. The amount of wiring involved is somewhat large, but the method employed is considered

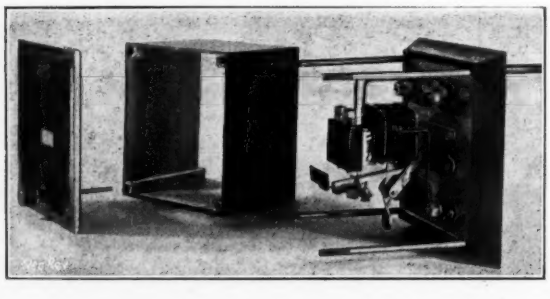


Fig. 4.—Indicator Relay.

to give greater reliability than one using less wiring and employing selector switches.

The above description of the scheme has been written by permission of Mr. H. C. Lamb, M.I.E.E., Chief Engineer and Manager of the Manchester Corporation Electricity Department.

A Young Engineer Takes Stock.

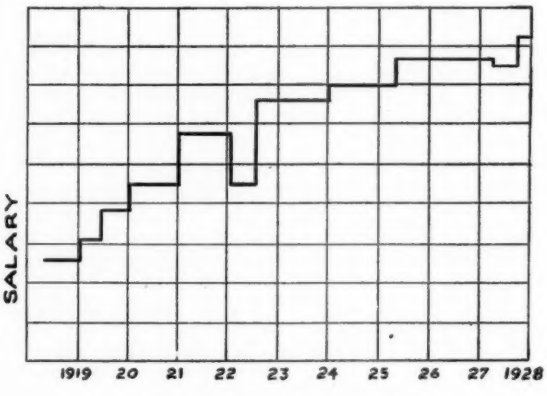
(COMMUNICATED).

ABOUT this season of the year a subdued murmuring and a faint rustling indicate the making of good resolutions and the turning of new leaves. Within a few weeks, of course, sharp cracking sounds will mark the breaking of the resolutions, and the leaves will be clean no longer, but these facts hardly call for comment. At this time, too, the daily Press is full of helpful articles under such titles as "Where are we going?" and "What is success?" It seems to be a good time for a young engineer to take stock of his position.

I call myself young, but at twenty-nine, perhaps, I ought to be in sight of a fairly profitable position offering some sort of future. Well, my job certainly affords experience, and perhaps has a future, but the future is a long way off and is slightly nebulous. My other jobs were like that, and I want to know whether I am justified in feeling a little bit discouraged.

I took the usual technical college training, but couldn't go through a works as I was wanted to make a tour of inspection of half the camps in England. When that little job was finished I was lucky enough to dodge a holiday on the Rhine, and got my first billet as a very junior assistant engineer at a power station. Thus I started to gain experience and look for prospects, an occupation which has engaged me ever since.

All told I have held six jobs, two for a few months



A Young Engineer's Salary Curve.

only. I have never been sacked, have had fairly regular rises in the positions I have held for any length of time, and have three useful testimonials.

I have to leave every job when the prospects fail to come along, although twice I have taken new situations at a lower salary on the strength of a rosy future.

In one section of electrical engineering I have had experience in the shops, test room, estimating and contract departments, on the road, and on the publicity side. My college diploma exempts from the examination for Associate Membership of the I.E.E., but how I am ever to get those necessary years of superior responsibility I don't know. I am not a clock watcher and have at least the ordinary amount of common sense. Am I doing as well as I can expect by getting about 30 per cent. more than a London 'bus driver? Shall I stick in my present job until somebody dies, or shall I get on the move again? It's all very difficult.

Of one thing I am very sure. It does pay to acquire knowledge, even if only in the satisfaction of knowing more than the other fellow. Of course, it is rather bad for one to know more than one's chief, but if that happens there is the obvious remedy—get another chief!

I suppose there are openings for young men in electrical engineering?—for young men who aren't brilliant scientists, but have a sound knowledge of their job and are prepared to work hard? In the other department, perhaps; but then it is very difficult to get a transfer from one department to another—the policy is to get in a new man so as to avoid any jealousy.

My last position was very comfortable, but the prospects came to an end. So I left that firm for another, and now have a very slightly more comfortable position, but have not yet seen any of the promised developments which were going to lead to a nice little job for me.

Where do I go from here? After ruling out a couple of organisations in which I don't think I should be happy, there remain about five which might have a use for me. I have worked for two of the five, so unless I throw away some years of specialised experience and start in a new line at less money, my scope is somewhat cramped. If I stop where I am I shall become still more of a specialist, and may or may not increase my salary cheque.

Herewith is given my salary curve. Am I too impatient, or ought there to be a more decided upward slope? I shall feel a little happier if some other young engineer writes to say that his salary curve is even flatter, but I should much prefer to be told how to give mine a more decided incline in the right direction. If there is anything wrong with me, I am quite prepared to try to put it right, but somehow I cannot help thinking that I should have done better in the soft-goods trade, or in some other industry not in its infancy.

The Operation of Rotary Convertors.

An analytical study of the causes of flash-over, and a *résumé* of the chief methods adopted in practice to minimise the danger of flash-over.

By WALLACE FORD, Wh.Sc., A.C.G.I., B.Sc., D.I.C.

TWO of the chief problems in connection with large rotary convertors for heavy traction sub-stations for d.c. railway electrification are to increase the capacity of the convertor to deal with heavy load fluctuations without flash-over at the commutator, and secondly, in the event of flash-over occurring, to prevent the arc spreading to the armature and field coils and to the framework of the machine. The main cause of flash-over at the commutator is the unstable voltage distribution round the commutator, which is brought about by sudden and oscillatory changes in the armature magneto-motive force, and any arcing which starts at the trailing edges of the brushes when the voltage between adjacent commutator segments exceeds a critical value, is assisted to spread by the movement of the commutator and by any accumulation of ionised gases between the brush arms. An analytical study of the action of a rotary convertor when the load is suddenly thrown off, shows the root causes of flash-over, *i.e.*, it reveals the conditions which produce the unstable commutator conditions. Any experimental work could comprise a study of the oscillatory transient voltages produced round the commutator when a sudden load-change occurs; the practicability and use of such investigation will be discussed later.

When a rotary convertor is in synchronism, but not loaded, *i.e.*, when the d.c. side is open-circuited, the machine can be considered as an unloaded synchronous motor, with the one modification that the brushes on the commutator short-circuit some of the armature coils The short-circuited armature coils have the effect of reducing the effect of the synchronising current, or conversely, cause the convertor to take a bigger current from the supply to produce the necessary synchronising forces. The alternating current taken from the supply transformer or a.c. bus-bars is the synchronising current (the wattless component of the synchronising current depending upon the amount of excitation of the field), together with the power component required to cover iron, friction and windage losses. The armature poles are locked-on to the field poles, and the angular displacement between the armature and field poles is very small.

When the d.c. circuit is closed and direct current is taken from the commutator, two separate effects may be considered as being produced. The first is similar to that due to the mechanical loading of a synchronous motor; as the load increases the armature poles lag farther and farther behind the field poles, and due to this displacement the synchronising current changes, and an additional a.c. is taken from the a.c. mains (or transformer) to supply the load current. The second effect is due to the fact that the load on the machine is not "mechanical," but "electrical"; the d.c. output from the commutator is collected from the armature winding, and the current in the armature coils due to the d.c. is in the opposite direction to that due to the a.c. supply. The actual current in any armature winding is, therefore, the difference between the a.c. and d.c. load currents, plus the a.c. synchronising current. The armature reaction m.m.f. is, therefore, a combination of the m.m.f.'s due to the a.c. and d.c.

The difference between load and no-load conditions comprises the following: a difference in angular displacement between armature and field poles; a difference in synchronising current; a difference in armature m.m.f. due to the fact that the no-load m.m.f. is produced entirely by the a.c., whereas the m.m.f. of the loaded convertor is due to the combined a.c. and d.c.; and finally, since at no-load there is no direct current, the commutating poles are not energised, while there is a large m.m.f. due to the commutating poles when the convertor is loaded. When the a.c. load is suddenly thrown off the convertor returns to no-load conditions, but the change produces unstable voltage-distribution at the commutator.

First, consider the relative positions of armature and field poles. With removal of the load the armature speeds up until its poles reach their new position of equilibrium relative to the field poles. The energy for this acceleration must be drawn from the a.c. supply, so that the drop of the supply current, a.c., from the load to the no-load value is retarded. Further, the armature poles are liable to hunt considerably before settling down to their new position relative to the field —this oscillation can be clearly seen by painting a de

sign on the end of the armature shaft and illuminating it by a neon lamp; the lamp should be supplied with a.c. from the supply to the convertor (with any necessary stepping-down of voltage to the order of 100 V) with a superposed d.c. supply at about 100 V. When the load is thrown off the design will be seen to move forward in the direction of rotation of the armature, oscillate slightly and then settle down to a new steady position. It is practically needless to emphasise that any such observation should be carried out on the end of the shaft remote from the commutator, in case any flashing occurs.

It is difficult to separate-out the three other effects due to the change from the loaded to the non-loaded condition, but the only effect which occurs at once, provided there is no flash-over at the commutator, is the total removal of all direct current and the m.m.f.'s due to it. If flash-over occurs the problem is further complicated; this will be dealt with later. Directly the d.c. is removed the full a.c. load current appears in the armature windings. The sudden changes in the m.m.f. distribution due to this change of current-distribution must affect the commutator voltage-distribution. Due to the reactance of the armature there is a transient rise of voltage across the opening d.c. circuit-breaker contacts, and it appears at the brushes.

Due to the sudden removal of the commutating-pole flux, which links the coils short-circuited by the brushes, circulating currents are set up which cause sparking at the brushes. Due to the fact that the armature is rotating, the coil short-circuited at the moment the commutating flux disappears is almost immediately open-circuited, but the effect of the commutating m.m.f. is felt over several coils and induced voltages will appear in the armature windings; these will also affect the commutator voltage-distribution. This effect will probably be small, since the d.c. load disappears at the same time as the commutating flux, and the effects of the two tend to neutralise each other; but due to the changes in the a.c. distribution, the effect will appear as slight sparking at the brushes. The synchronising current depends upon the relative positions of the armature poles and field poles, so that the synchronising current changes from its load to its no-load value in an "oscillating" manner due to the armature-position oscillation described above. The effect of this oscillation will affect the commutator voltage-distribution.

It will be seen, therefore, that four effects appear at the commutator, when the d.c. load is thrown off, as follows: (i) a transient voltage-rise between the brushes due to the armature reactance; (ii) oscillatory transient voltage changes due to the re-distribution of armature m.m.f.; (iii) oscillatory transient voltage changes due to the speeding-up of the armature and the oscillation about its no-load position; and (iv) sparking at the brushes due to the removal of the commutating flux and also due to the above three conditions.

These conditions may start flashing or a flash-over round the commutator if the load-change is of sufficient magnitude, *i.e.*, if the change is brought about by the opening of the d.c. circuit breakers on overload. When a rotary convertor is working on heavy load, there is a tendency to form large quantities of ionised gases between successive brushes round the commutator, and these gases assist arcing to the machine frames or to the armature windings when such arcing is set up by the voltage-rise at the brushes (see (i) above).

The term "flashing" implies rather a different meaning from "flash-over." Flashing generally means arcing from the brush-arms to the machine-frames, armature windings, field windings, or to parts of the commutator, whereas flash-over means the setting-up of a continuous arc from brush-arm to brush-arm, a condition which may spread right round the commutator and ring the machine in flame until the a.c. circuit breakers operate. Flash-over occurs only when the convertor is subjected to short-circuit, or to a heavy overload approaching short-circuit value. Flashing is liable to occur under steady overload conditions—and it is generally considered that flashing is helped by accumulations of ionised gases, although some engineers tend to look for other causes, and to discountenance the fact that conducting gases alone produce flashing conditions.

The principal methods of preventing flashing and of protecting the commutator and windings when flashing occurs are as follows:—Fire-proof insulating covers and barricades between brush-arms and at the back end of the commutator (between commutator and windings); fans incorporated in the convertor (or the equipment) which direct a stream of air from back to front of the commutator, and so blow the ionised gases off the commutator and away from the machine; and magnetic blow-outs to quench arcs.

The above methods are suitable for dealing with flashing due to sustained overload conditions, *i.e.*, arcing mainly assisted by accumulations of conducting vapours, but they will not give proper protection against flash-overs at the commutator when heavy overloads or short-circuits are suddenly removed, and the machine is required to remain in synchronism and connected to the a.c. supply, *i.e.*, when the d.c. circuit breakers operate before the a.c. breakers.

Suppose a rotary convertor to be short-circuited: the d.c. terminal voltage drops practically to zero, but if the d.c. circuit is opened by the circuit breakers, the d.c. voltage is almost immediately restored and, due to armature reactance, reaches a transient value of about twice the normal terminal voltage. This condition is an aggravation of the conditions described previously for sudden load change. It is this effect which transforms flashing into flash-over. If a flash-over is set up it is, of course, practically equivalent to short-circuiting the d.c. side without the provision of overload circuit-breakers. Flash-over is not complete until the arc has been drawn from one brush-arm to another, and this needs an appreciable time, although it is not necessarily dependent upon the time taken for a commutator segment to travel from one brush-arm to the next.

There are two methods of dealing with flash-over: one is by installing high-speed circuit breakers on the a.c. side, and the other by using flash-barriers between the brush-arms, so designed as to prevent an arc spreading round the commutator after it has started at the trailing edges of the brushes.

The second method is not the same as a simple flash barrier between the brush-arms, but consists of a contrivance for attenuating the arc, "scooping" it off the commutator and throwing it out radially. A device of this nature is much favoured for traction rotary convertors in the U.S.A. The high-speed circuit breaker is adopted so that, in the event of flash-over occurring, the power may be cut off from the convertor in the shortest possible time. Generally, the d.c. circuit breakers are arranged to operate before the a.c. breakers, since, if the a.c. circuit were opened first, power would tend to flow back into the convertor from the d.c. system. In the event of a short-circuit, therefore, the d.c. circuit is opened, and if the resultant internal effects produce flash-over, this is equivalent to a second short-circuit, and the a.c. breakers must cut off the a.c. power before the flash-over becomes serious. This means that, from the time when the a.c. current due to flash-over reaches the tripping value of the a.c. circuit breakers, the tripping, opening and arc quenching of the breaker must be accomplished in the shortest possible time. As a matter of fact, the high-speed a.c. circuit breaker was developed for, and has its greatest application in, the protection of rotary convertors for electric traction.

A further consideration arises out of the fact that the energy in the flash-over is taken principally from the kinetic energy of the convertor armature. With the heavy load on the armature due to the initial setting-up of the flash-over, the armature slows down and its poles take up a new position relative to the field poles. The kinetic energy given up in this deceleration

appears as electrical and heat energy in the flash-over. The angular displacement increases as the flash-over persists, the commutating conditions get worse, and the production of conducting vapour is increased. The flash-over effect is therefore cumulative. About 80 to 90 per cent. of the energy in the flash-over is supplied from the kinetic energy of the armature, and only quite a small proportion from the a.c. mains. Of course, as the angular displacement of the armature increases the synchronising current from the a.c. mains also increases. It is obvious, therefore, that the a.c. high-speed circuit breakers must be designed to operate at a lower current value when the current-rise is rapid.

The following arrangement is in use on a large railway traction system in which d.c. is supplied to the traction motors at 1,500 V.; the system has given satisfaction up-to-date. On the d.c. side, a high-speed circuit breaker is situated in the main negative connection to the convertor, and a load-limiting resistor is connected across its terminals. This breaker is arranged to trip only on a pre-determined value of steady overload. The breaker in the main positive connection is arranged to trip on sudden current-rise, but only when such current is in the direction opposite to normal, *i.e.*, when d.c. power is flowing into the convertor. The positive and negative breakers are interlocked so that when the negative breaker opens on overload the load-limiting resistor is inserted across the opening and limits the current to twice rated full-load current; almost immediately afterwards the positive breaker opens and isolates the machine from the d.c. bus-bars. Hence the d.c. load is removed in two steps and the convertor has more chance of remaining in synchronism, connected to the a.c. side, than if the load were removed suddenly, when flash-over would probably be inevitable.

If, however, there is a sudden short-circuit on the d.c. side, the a.c. high-speed breakers, being set to operate on the " rate-of-current-rise " principle, open before the d.c. breakers. Thus there is a reversal of power from the d.c. side, the convertor tending to keep running as a motor taking power from the d.c. system. This operates the positive breaker and completes the isolation of the convertor. This is only one method, applicable to large machines, for protection against flash-over. In smaller machines the overload may be removed in one step, any tendency of flashing being taken care of by devices on the brush rigging.

Since heavy load fluctuations are the cause of flashing, and, perhaps, flash-over, the practical requirements are definite and satisfactory methods of dealing with flashing and flash-over, and of increasing the power of the convertor to deal with heavy load changes without being susceptible to either. The principal methods of achieving the latter end comprise limitations of the rate of change in m.m.f.'s in the convertor consequent upon changes in load demand, and limitations of the rate of load change. These limitations are effected by using a big air-gap for the commutator pole, by using high-reluctance commutating poles, or by introducing external reactances into the d.c. load circuit. The resistance to flash-over can also be increased by making the path between the brush arms as long as possible; this can be achieved by increasing the diameter of the commutator, and also by enclosing the brushes in special " radial " brush-holder units fitted with insulated covers. With modern methods of construction, safe peripheral speeds of commutators can be increased, and it is not unusual to find the commutator with a diameter equal to that of the armature. Such a design allows better facilities for getting rid of ionised gases from the commutator.

A practical study of the root causes of flashing and flash-over would probably serve no really important purpose. Designers have long been occupied and much research has been carried out in connection with methods of reducing the susceptibility of rotary convertors to flash-over. Manufacturers have realised that the conditions set up in the convertor when the load changes suddenly are inherent to the type of machine, and attention has been directed to the prevention of the phenomenon, and to the limitation of its effects.

Reviews.

A Course in Electrical Engineering. Volume II. Alternating Currents. By CHESTER L. DAWES, S.B., M.A.I.E.E., Assistant Professor of Electrical Engineering in the Harvard Engineering School. Pp. xvii+618; figs. 483. London: McGraw-Hill Publishing Co., Ltd. Price 20s. net.

The volume under notice is the second edition of this work, and while, for the most part, retaining the form of the first edition, it has been amplified in several important respects. The author states, in the preface to the second edition, that the book was originally primarily intended for the use of students taking courses, the fundamental subjects of which were non-electrical, and that one object of the additions in the second edition is to make the book more suitable for students taking courses which are mainly electrical.

As regards evening and other part-time students this object has probably been achieved, but the treatment hardly seems sufficiently complete as to permit of its use as a text book for full-time university courses, unless its perusal is followed by the reading of more specialised and detailed books. On the other hand, the book appears excellently suited for the use of full-time students whose main interest lies in non-electrical subjects.

As regards contents, the book is chiefly concerned with a study of the problems of alternating-current circuits and of alternating-current machines, but chapters are also devoted to such subjects as measuring instruments, transmission of power, electron tubes and illumination. The most interesting addition is a chapter dealing with the application of complex quantities to electrical problems. Rectangular and polar notations are both employed, and the use of the method in later portions of the book is pleasing.

The book is very accurately written and few criticisms are possible, though we note that the natural frequency of a circuit is given as $1/2\pi\sqrt{LC}$. This is only true if the resistance is negligibly small, and though the effect on the frequency of taking the resistance into account is not considerable, it should be pointed out.

Again, when dealing with the starting of squirrel-cage induction motors, attention is devoted to the relative starting currents resulting from the several methods, but the question of the relative starting torques per ampere of line current, an important matter, is not raised.

In connection with the starting of synchronous motors some interesting methods, of a mechanical nature, for starting up against heavy loads, are described.

Special commendation may be given to the diagrams, particularly the half-tone reproductions. These are more instructive than is often the case and are well reproduced; indeed, two of them, one dealing with an arc over a string of insulators and another showing an example of flood lighting, are really works of art.

Electrical Engineering Economics. By D. J. BOLTON. Pp. xi+305; figs. 27. London: Chapman & Hall, Ltd. Price 21s. net.

Really good and useful books on engineering economics are so few and far between that the present volume may almost be regarded as unique. In the preface the author rightly emphasises the sheer necessity for co-ordinating economy of manufacture with that of performance, as the overall value of a piece of apparatus can only truly be assessed when these two aspects are taken into account. The present volume makes a very creditable attempt to explain the principles of the monetary values of the performance of electrical plant and the application of these to the important question of deriving maximum economy of operation. The subject is considered under three headings, namely, General Principles, Choice of Plant, and finally Supply Problems. The first part, namely, General Principles, covers the field of consideration of capital, interest and sinking funds, total depreciation, annual depreciation, productivity and the basis and method of engineering applications. The treatment of these subjects follows the fairly well defined lines which have in some cases been laid down elsewhere, and which in any case are generally understood. It is, however, of the utmost value to the manufacturing, purchasing, and supply engineer to have the different data available in a single volume in so concise and orderly a manner. In the second part, which is concerned with the choice of plant, the author deals with Kelvin's law for cables and with the economical selection of motors, transformers and lamps. In this section, particularly that part of it dealing with motors and transformers, the author appears to advocate the under-running of plant both from the point of view of current and voltage, although he throws the onus upon the dictates of the intending purchaser's economic conscience. We can hardly imagine a purchaser ordering a transformer, for instance, of a higher output *and voltage* than is really required (having in mind, of course, the necessity or not, as the case may be, for additional spare output) for the sake of the paper economy that might be calculated by under-rating the iron and copper circuits when running the plant at the normal service conditions. The illustrations are, however, useful if only to serve as an indication of the extremes to which so-called economy calculations can be taken. The third part of the book, which discusses the problems of electricity supply, deals

with tariffs, load and diversity factors, two-part tariffs, power factor, and the choice of static and synchronous condensers. So far as it goes one cannot reasonably dissent from the author's views as expressed in this portion of the book, but we think the subjects of tariffs and load and diversity factors have been accorded all too scanty consideration. Appendices are included giving equations and tables for interest and sinking funds, the estimated useful life of engineering assets and the efficiency of electrical machinery when under-run, and finally questions on the subject matter of the volume.

It will be appreciated that in an economical study of the kind covered by this volume it is quite impracticable to assign a definite commercial value to all the factors which contribute towards the finished article. Nevertheless, those factors have a very important bearing upon the ultimate life of the plant or apparatus and upon its freedom from premature failure. Those calculations of the kind described by this volume give results which can only be regarded as a partial solution to the selection of electrical plant for a given service, and the results of such calculations should not be regarded as the sole criterion for the ultimate selection of any given plant which may be required.

The volume is one which we have no hesitation whatever in recommending for the closest attention of all branches of the profession and as being one, the study of which will well repay whatever time may be spent upon it. The publisher's name is sufficient indication of the excellence of the production of the volume.

Electrical Sub-stations. By H. BRAZIL, M.I.E.E. Pp. vii+215; figs. 92. London: Edward Arnold & Co. Price 12s. 6d. net.

In this book the author gives an account of present-day practice in the design, maintenance and operation of sub-stations; he also deals in a practical way with the matters of converting plant, switchgear, and protective gear with reference to his main subject.

As may be expected, Mr. Brazil is of the opinion that there is still a distinct future for direct current distribution, and he has written some useful notes on the peculiar difficulties in developing a d.c. distributing system, arising from the necessarily smaller number of sub-stations as compared with an a.c. system. The author describes his method of using resistances in the distributors fed direct from the sub-station, but we imagine that many engineers would prefer to regulate the load on these feeds by suitably sectionising the network. The notes on the design of large direct-current sub-stations are also very useful.

The chapter dealing with static transformer sub-stations is somewhat superficial in character. Illustrations such as figs. 7 and 8 are hardly called for in a work of this kind, whilst the paragraph on the induction regulator only describes the single-phase type. The chapter dealing with switchgear contains many shrewd and practical notes on this important subject, and the author's regulations for the repair, testing, or cleaning of extra-high-pressure gear are very sound. Armour-clad gear is now supplied by so many manufacturers of switchgear that it is hardly correct to associate this type of gear with the name of one firm.

In the chapter on protective gear the author's outlook appears to be somewhat narrow, for we find no reference to the systems employing the biasing principle. The self-balance system described on p. 59 refers to the protection of an alternator, and is somewhat out of place in a work on sub-stations. The analogous method applicable to transformers might have been described.

The chapter on converting plant gives a good general description of the usual type in use. We think that the reference to the glass bulb type of rectifier is somewhat scanty, as there is every prospect that this plant will find extensive use in residential areas where it is decided to retain direct-current distribution. Although the author implies that this type of rectifier is suitable only for small outputs, it may be recalled that there is a glass bulb rectifier sub-station designed for a 3,000-kW rating in the London area.

The author gives a good account of modern automatic switchgear for non-attended sub-stations. There is a useful chapter on the prevention of noise, whilst we are not surprised that the subject of limiting resistances receives due prominence.

The final chapter on continuity of supply is one deserving of special study, and we endorse the importance which the author attaches to this subject. It would have been well if greater stress had been here laid on the periodical testing of protective gear, and some practical notes on the carrying out of these tests would have been useful.

We can recommend this book as a practical and very readable account of modern sub-station practice.

Electric Circuits, Theory and Applications. Vol. I. "Short Circuit Calculations and Steady State Theory." By O. G. C. DAHL, S.B., S.M. Pp. x+390; figs. 228. London: McGraw Hill Publishing Co. Price 25s. net.

In this book the author has carried the subject of the arithmetic of alternating currents a stage further than is found in the usual textbook of alternating current theory. The work is intended to be a textbook for the use of post-graduate electrical engineering students in the Massachusetts Institute of Technology. Although the subject of alternating current calculations has been taken, in this book, to a stage well beyond that required by the average engineer, a study of some of the problems dealt with by the author will be well repaid, not only for the clearer insight into fundamentals which will be so gained, but also by the light which will be thrown on many matters of real every-day practical interest.

The book commences with a chapter dealing with the calculation of network impedances for the evaluation of short-circuit currents. The convenient method of using the equivalent star for a delta combination of impedances is explained and illustrated, and some useful notes are appended on the experimental solution of impedance problems by the use of calculating tables.

Considerable space is devoted to the subject of unbalanced polyphase circuits, and the author outlines the two usual methods of solving problems of this kind, the one by the use of Kirchhoff's laws, and the other by the resolution of an unsymmetrical system into two symmetrical systems of opposite phase sequence.

In spite of the apparently artificial character of the conceptions involved in the latter system, it has proved itself to be a most potent method for the solution of problems dealing with unbalanced three-phase circuits. The symmetrical co-ordinate method is, in our opinion, best developed by the use of a vector operator, which represents a rotation through 120 degrees, and which is algebraically equal to one of the complex cube roots of unity. The use of this operator not only enables the fundamentals of the system clearly to be visualised, but also enables the various geometrical methods of resolution easily to be proved. The author's method of establishing the basis of the system, in which the operator in question is not specifically used, is, we find, somewhat difficult to follow. The author deals with the operation of transformers when delivering unsymmetrical loads, and with the more important and more interesting question of the operation of alternating current motors on three-phase systems in which the voltages are unbalanced. This chapter is worthy of study by all electrical engineers.

The remaining portion of the book deals mainly with transmission line problems. Short transmission lines are first considered, and the several approximate methods of calculation are explained. The author then passes on to exact calculations for lines of unlimited length, and shows clearly the application of the hyperbolic functions to problems of this character. An important chapter is devoted to harmonics, their genesis, and their effect on the operation of transmission lines. Further chapters deal with the construction of transmission line and synchronous machine charts, and the concluding chapter is devoted to the consideration and detailed solution of specific steady-state transmission-line problems.

This book is the most penetrating we have yet seen of those dealing in a practical way with alternating current circuit calculations. It abounds in fully worked examples for the guidance of the student. Although it will not appeal to the average engineer, it should be of the greatest interest and use to those who are concerned with technical problems relating to the transmission of electric power over long distances.

The Spectroscopy of the Extreme Ultra-Violet. By T. LYMAN, Ph.D. Second edition. Pp. vii+160; figs. 7. London: Longmans, Green & Co.

No research worker whose investigations take him into the region below 2,000 A can dispense with Prof. Lyman's book. The author, as is well known, has devoted himself almost exclusively to the study of the extreme ultra-violet, having made over twenty contributions to the literature of the subject, and the usual designation of the fundamental series of hydrogen by his name is a fitting tribute to his pioneer work, second only to that of Schümann himself. This edition follows the same general lines as the first, but the large amount of work done in the last fourteen years in this field has necessitated the re-writing of certain sections of it. The stimulus for this work has, of course, come from the simultaneous development of the Bohr theory of the atom, with its recognition of the fact that electron energies corresponding to the ionization potentials of many elements also correspond to spectra in the Schümann region, and particular interest thus attaches to Section III (Part II), on emission spectra, where we note that the line spectra of over sixty elements have now been at least partially described in this region, quite apart from molecular bands. The other parts of the book are very largely concerned with matters of technique, and do not call for detailed comment here. There is a good bibliography as an appendix, which appears to be complete up to about the middle of 1927, but at the same time considerable work has been done even since then, including the description by Prof. K. T. Compton and Dr. Boyce of their beautiful method of exciting gas spectra in this region by controlled electron impacts, and Dr. Rupp's very recent production of electron spectra by a ruled grating, and this monograph must thus be regarded as marking a stage in the growth of a rapidly developing subject, and not as indicating the attainment of any degree of finality.

K. G. E.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

E.D.A. Activities.

We have received from the British Electrical Development Association a supplementary programme of its activities for January. Efforts during this month are being directed particularly to domestic lighting and colour lighting. To this end the month's newspaper advertising will put forward the beauty, convenience, and cleanliness of electric light, and many attractive "lay-outs" have been prepared for the purpose. Two simple but effective window displays have been designed for the use of the trade, and a special poster (E.D.A. 729) has been printed in seven colours bearing the slogan "For Health's Sake Use Electricity." February is to be devoted to the subjects of wiring and spring cleaning, and local Circles are asked to discuss the arrangements for this part of the campaign at their January meetings. Two new illustrated lectures are available: For January, "Electric Lighting in the Home"; and for February, "Transforming the Homes of Britain."

The G.E.C. in 1928.

Some details of its work during the past year which we have received from the GENERAL ELECTRIC CO., LTD., prove that the company is in the forefront of electrical development. Among the outstanding items included in the list brief mention may be made of the following. In the field of turbo-alternator manufacture progress has been made in increasing the output of 3,000-r.p.m. machines. A set of 40,000 kVA capacity is in hand for the Battersea Corporation and two others of 18,750 kVA are being made for Poplar and Southampton. Two 40,000-kVA sets running at 1,500 r.p.m. are being erected in the new Hams Hall station, Birmingham, and several large machines have been dispatched to various parts of the Empire. An automatic sub-station at Aldwych House was completed for the Charing Cross Electricity Supply Co. during the year. This station, which houses four 750-kW motor-convertors and the necessary control equipment, is claimed to be the largest in the country. An interesting example of automatic control applied to a synchronous condenser was recently undertaken by the company in connection with the power-factor regulation in an ironworks. In this a 400-kVA machine is switched in at times when the load approaches the maximum demand, and out again at light-load periods. Plant and switchgear is being produced at the Witton Works for the Palestine hydro-electric scheme. The main plant comprises two 7,500-kVA vertical-spindle alternators driven by Boving turbines. High-pressure outdoor switchgear has been supplied to Australia and New Zealand. The traction work carried out during the year included a 2,250-h.p. electric locomotive for the Great Indian Peninsula Railway and two 340-h.p. Diesel-electric locomotives for the North-Western Railway of India. An order is in hand for 920 240-h.p. traction motors, &c., for the London Underground Railways. In the direction of industrial electrification, the company has nearly completed a contract for the electrical equipment of a large artificial silk spinning mill with 3,500 spindles directly operated by small high-speed vertical motors. One of the most important contracts received during the year was, of course, the £500,000 order placed by the Central Electricity Board for a 132,000-V transmission line under the South-East England Scheme.

In many other directions—lighting, heating, cooking, radio work, &c., the company has made progress and improvement. Among the orders for materials-handling equipment received by Fraser & Chalmers Engineering Works (one of the company's branches) is one for complete self-unloading equipment for two coal-carrying steamers.

The B.E.A.M.A. and Industrial Credit.

Just before Christmas at the final meeting of the Sound Currency Association, a brief reference was made to the British Electrical and Allied Manufacturers' Association's recent "survey" concerning trade credit. The Sound Currency Association was formed in 1919 with the object of pressing upon the Government the need for the restoration of the gold standard in this country and that object having been achieved there was no further need for the existence of the Association, and it has accordingly been wound up. The whole of the work was of a voluntary nature, but it was strongly supported by the leading bankers, economists, and others in this country. Mr. D. M. Mason, who has acted as chairman of the Association since its formation, referred to the B.E.A.M.A.'s manifesto and said there seemed to be a feeling in certain circles that there was a lack of credit to-day. He contended, however, that there was no such lack and that everybody with good security had no difficulty in obtaining any credit that they desired. At the same time it was impossible to force credit into the country because the only result was inflation and the very evils which the Association had endeavoured to prevent. The British Electrical and Allied Manufacturers' Association had suggested that the depression during recent years had been due to the monetary policy of the Bank of England, but the system of the Bank of England was, in a sense, governed by the trade of the country. It did not provide the trade but existed for the purpose of circulating trade and the function of the gold standard was to enable exports and imports to develop to the greatest extent. That system enabled this country to build up a foreign trade before the war second to none in the history of the world, and it was a satisfaction to know that we had now got a currency which was convertible into gold, was elastic, and absolutely free from any political influence whatever.

Cookery Exhibition Results.

We are informed that a leading manufacturer of electric equipment reports that his orders and inquiries at the recent Cookery and Food Exhibition amounted to over £6,000. A competing firm mentions the figure of £7,200. Another firm claims to have sold, among other equipment, 100 electric hand-dryers. A manufacturer of electrical refrigerators and other plant estimates his business transacted at Olympia at £700 per day.

Simplification in an American Lamp Works.

A striking illustration of the fact that reduction of types often stimulates sales is found in the simplification undertaken by a large lamp manufacturing concern in the United States, as reported in a recent issue of *Manufacturing Industries*. General lighting types were reduced by this company from 1,260 to 180 and general lighting voltages to three, which accounted for 95 per cent. of the demand. Types of lamp bases were reduced from 179 to three. The company reports that, as a result, it was able to reduce prices by 50 per cent. in a period of 12 years, and that sales increased by 74 per cent. in four years. Freight and warehousing expenses were reduced, floor space was more efficiently utilised, and the efficiency of the employés increased.

Indian Electrical Imports.

The *Board of Trade Journal* gives details of Indian import trade during the first half of the fiscal year (April-September, 1928). It is stated that the improvement in the import trade of machinery and millwork continued. The value of imports of electrical machinery rose from Rs. 97 lakhs in April-September, 1927, to Rs. 108 lakhs. The United Kingdom's share rose from Rs. 80 to Rs. 83 lakhs, that of the United States from Rs. 6 to Rs. 14 lakhs, and Germany's from Rs. 5 to Rs. 7 lakhs. The imports of electrical instruments, apparatus, &c., rose from Rs. 139 to Rs. 147 lakhs. The British share advanced from Rs. 91 to Rs. 94 lakhs, that of Germany from Rs. 13¼ to Rs. 14¼ lakhs, Holland from Rs. 6 to Rs. 7¼ lakhs, Italy from Rs. 4 to Rs. 6 lakhs, and Japan from Rs. 1¼ to Rs. 2¼ lakhs. On the other hand, American shipments were slightly reduced from Rs. 18 to Rs. 17 lakhs. "Other countries" supplied Rs. 5¼ lakhs' worth. Analysing the above total, it is found that the imports of electric wires and cables fell from Rs. 46 to Rs. 45 lakhs. The share of the United Kingdom, however, advanced from Rs. 39 to Rs. 41 lakhs. That of Germany remained stationary at about Rs. 2 lakhs, and Holland's at Rs. 1 lakh, while imports from the United States fell from Rs. 2¼ lakhs to Rs. 64,000. The trade in electric glow lamps and parts thereof rose from Rs. 12¼ to Rs. 15 lakhs. The British share advanced slightly from Rs. 3¼ to Rs. 4 lakhs, that of Holland from Rs. 4 to Rs. 5¼ lakhs, and "other countries" from Rs. 3¼ to Rs. 4 lakhs. The German share fell from over to just under one lakh. Electric lamps of other kinds amounting to Rs. 7 lakhs were obtained from the United States (Rs. 4 lakhs), Germany (Rs. 1 lakh), the United Kingdom (Rs. ½ lakh), and "other countries" (Rs. 1 lakh). Electric fans to the total value of nearly Rs. 17 lakhs were obtained from the United Kingdom (Rs. 10 lakhs), Italy (Rs. 5 lakhs), the United States (Rs. ½ lakh), and "other countries" (Rs. 1¼ lakhs). Of a total of Rs. 23 lakhs' worth of unenumerated electrical apparatus the United Kingdom supplied Rs. 14 lakhs, the United States Rs. 4½ lakhs, and Germany Rs. 3½ lakhs.

Accumulators were imported to a total of Rs. 8¼ lakhs, of which the United Kingdom supplied over Rs. 7¼ lakhs and the United States Rs. ¾ lakh. Meters and switchboards were entirely obtained from the United Kingdom, but of the Rs. 6¼ lakhs' worth of batteries imported the United States supplied nearly Rs. 4 lakhs, the United Kingdom only Rs. 91,000, and "other countries" Rs. 1¼ lakhs. Imports of wireless apparatus expanded from Rs. 6¼ to Rs. 7¼ lakhs. The British share rose from Rs. 5¼ to Rs. 5¾ lakhs, that of the United States from Rs. ¼ to Rs. ½ lakh, and "other countries" from Rs. 1 to Rs. 1¼ lakhs.

Local Exhibitions.

TAMWORTH.—Since, four years ago, the Pooley Hall Colliery Co., Ltd., Polesworth, near Tamworth, undertook the public supply of electricity through its Electric Supply Department (manager: Mr. J. C. Chaytor) considerable progress has been made in the district, which includes about a dozen villages. There are now about 5,000 consumers. To stimulate this progress an exhibition was held recently at the Assembly Hall, Tamworth; it included a competition for housewives who do their cooking by electricity. There were 348 entries and many prizes were awarded. The premier prize, a silver challenge trophy, was presented by the Credenda Conduits Co., Ltd., whose cookers are used throughout the company's supply area. Colonel Darcy Chaytor, C.M.G., C.B., presided at the opening ceremony, at which Councillor G. H. Jones, chairman of the Tamworth Electric Supply Committee, introduced Lady Brooks, of the Birmingham and Midlands Branch of the W.E.A., who spoke of the advantages of electricity.

MANCHESTER.—An exhibition of industrial electrical equipment will be held at Belle Vue, Manchester, from January 7th to 12th, under the auspices of E.D.A., the Manchester and Salford Corporation Electricity Departments, and the Lancashire Electric Power Co. Among the exhibits will be electric furnaces, baking ovens, electric welding plant and tools, soldering irons, boilers and coffee-making machines, and heating elements. Admission to the exhibition will be free by tickets, obtainable from E.D.A., or the Corporations named, which will have an inquiry bureau for the benefit of visitors. The organisers hope to secure a good attendance of operatives, as well as employers. The exhibition will not be of interest to the general public.

SHEFFIELD.—During the annual congress of the Royal Sanitary Institute next July at Sheffield, the Electric Supply Department is to hold an exhibition of electric heating, lighting and power appliances in the Cutlers' Hall.

Canadian Order for Sweden.

It is reported from Stockholm that the Allmänna Svenska Elektriska A.B. has secured in competition with other firms an order from the city of Winnipeg for the supply of two generators, each of 10,000 h.p., valued at 1,430,000 kr.

Central Electricity Board Contracts.

In this issue the Central Electricity Board calls for tenders for the supply, delivery and erection of 132,000-V overhead transmission lines in connection with the Central England Scheme and the North-West England and North Wales Scheme.

New Catalogues and Lists.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, Newman Street, Oxford Street, W.1.—A pamphlet describing B.T.H. thermostatic metal and its applications.

MESSRS. FERRANTI, LTD., Hollinwood, Lancs.—Lists M.F. 30 and 30/1, dealing with the company's Type F.C.c. a.c. watt-hour meter. Illustrated and priced.

THE METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Descriptive Leaflet No. 452/1-1, containing illustrated notes upon "Metrovick" self-contained turbo-generator sets.

THE WHOLESALE FITTINGS CO., LTD., 23, Commercial Street, E.1.—Supplement No. 225, containing particulars and prices of "Altolite" glassware.

MESSRS. L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, W.C.2.—A well-illustrated pamphlet containing a full description of the construction and employment of a new "Universal" electric washer and dryer. Priced.

THE CONSOLIDATED PNEUMATIC TOOL CO., LTD., 170, Piccadilly, W.1.—Pamphlet S.P. 126, illustrating and describing the "Little Giant" pneumatic coal pick.

METROPOLITAN-VICKERS AUSTRALIA PTY., LTD., Auburn (N.S.W.) and South Melbourne (Vic.).—A series of illustrated pamphlets advertising the company's truck-type switchgear, oil circuit-breakers, and switchboards.

LIGHTING TRADES, LTD., 30-31, Farringdon Street, E.C.4.—Catalogue No. 422, containing illustrations, details and prices of "Eltee" bakelite electrical accessories.

Calendar blotters for January have been received from Messrs. MAVOR & COULSON, LTD., 47, Mile End, Glasgow; POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, W.C.2; Messrs. H. J. BALDWIN & CO., Nottingham; and Messrs. WARREN BROS. (MIDDLESBROUGH), LTD.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—A folder containing particulars of the company's ozone-proof cables; and a well-illustrated brochure dealing with the "Prescot" wiring system.

Chinese Reconstruction.

The Chinese National Commission of Reconstruction, Nanking, recently offered prizes for papers setting forth practical and useful construction schemes falling under any of the following headings:—Communications; navigation and hydro-electric enterprises; agriculture; commerce; mining; harbour and port development; industries; and capital city building. Authors of constructive projects which are adopted by the Commission may be appointed to direct the schemes which they put forward or be employed as advisors.

Calendars and Diaries.

The 1929 calendar of the GENERAL ACCESSORIES CO., LTD., 125, High Holborn, W.C.1, has neat monthly date slips and bears illustrations of the company's switches, plugs and sockets, fuses, &c.

We have received a very neat wall calendar from the CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1. A set of monthly slips is suspended beneath a picture of a power station.

The 1929 calendar of Messrs. FRANCIS POLDEN & CO., LTD., 56, Cannon Street, E.C.4, consists, as usual, of neat monthly sheets provided with a date-indicating device.

A plain calendar with boldly-figured daily slips has been received from ROTUNDA, LTD., Manchester Road, Denton, Manchester.

A view of a battery of cooling towers and a block of salmon-coloured date slips comprise the 1929 calendar of the DAVENPORT ENGINEERING CO., LTD., Bradford.

The LIVERPOOL ELECTRIC CABLE CO., LTD., Bootle, again employs a view of the Mersey for its calendar, which has monthly date slips.

Ample memorandum space is given in an appointments calendar sent us by the LEA RECORDER CO., LTD., 28, Deansgate, Manchester.

Messrs. ROPER BROS., 5, South Anne Street, Dublin, have altered the character of their calendar this year; it consists of a neat card upon which a block of large daily slips is mounted.

Refills for their "moving ring" calendar have been received from Messrs. HOPKINSONS, LTD., Huddersfield.

From the IRON & NICKEL BATTERY CO., 17-19, Cockspur Street, London, S.W., we have received a handy ten-inch rule with English and metric measure marks; and a calendar for the complete year 1929 is compactly arranged from end to end.

Monthly sheets bearing illustrations of the goods supplied by the company form the calendar of Messrs. W. H. WILLCOX AND CO., LTD., 38, Southwark Street, S.E.1.

Mr. FERNAND ESPIR, 86-88, Queen Victoria Street, E.C.4, has sent us a new set of daily slips for his calendar.

A girl with a smile forms the subject of the calendar received from Messrs. DOWNES & DAVIES, Stanley Street, Liverpool, which is a very pretty production.

An engagement calendar with monthly sheets comes from Messrs. W. H. SUGDEN & CO., LTD., Glenny Road, Barking, E.

Each of the four quarterly sheets which form the 1929 calendar of Messrs. CROMPTON PARKINSON, LTD., Chelmsford, bears an excellent drawing in colour of a scene in which electric motors play a part.

The LANCASHIRE UNITED TRANSPORT & POWER CO., LTD., Atherton, Lancs., has sent us a little wall calendar with a view of some Scotch firs and monthly date slips.

A pocket diary has been issued by the STANTON IRONWORKS CO., LTD., of Stanton-by-Dale, near Nottingham.

Messrs. B. S. & W. WHITELEY, LTD., of Leeds, have again sent us a wall calendar with daily date slips, each bearing a more or less interesting literary quotation.

A representation of a "Mullard" valve with a picture of a fair lady and a block of daily slips again form the calendar of the MULLARD WIRELESS SERVICE CO., LTD.

Russian Electrical Production.

It is calculated that the State Electrical Trust (High Pressure) will be able to turn out products of the value of 210,000,000 roubles in the current financial year, provided that a sufficient supply of copper is available. In the case of the Low-Pressure Trust the works are at present fully occupied, and are working two shifts daily.

Unemployment in Australia.

In a recent article contributed to the *Industrial Australian and Mining Standard*, Mr. P. J. Pringle (chief engineer of the Electric Supply Co. of Victoria, Ltd.) compares unemployment in the Commonwealth of Australia and its constituent states with conditions in Great Britain, and draws certain conclusions. By means of curves he shows that while the proportion of unemployed in the individual states has shown wide variations during the past eight or nine years the fluctuations for the Commonwealth as a whole have been similar in nature to those of Great Britain. For instance, the lowest level was reached in both cases in 1920, while in the succeeding year the curves sprang up to their maxima. The cyclical nature of Australian unemployment is very evident from the curve. Dealing with causes, Mr. Pringle states that when world prices slumped in 1921 Australia refused to undertake a gradual deflation or readjustment of production costs, with the result that high internal costs of production make it impossible to export profitably all primary products, with the exception of wool. The economic position has been ignored. The engi-

neering trade has nearly 11,000, or 17 per cent., of its members unemployed. The Federal Arbitration Court, instead of helping to lower production costs in keeping with those of other countries, did the reverse by imposing a 44-hour week. Mr. Pringle concludes by stating: "The education of Capital and Labour must progress so that they can appreciate the dictum that capital, profits and wages are only limited by production. When this sound fact is realised, we shall do much to ease the satisfactory solution of our long-delayed readjustment problem, which during its progression must necessarily be accompanied by much adversity."

Scope for Development.

Mr. Henry A. Porter, research editor of the *Magazine of Western Finance*, lists the reasons advanced by competent authorities as to the certainty of continuous growth and prosperity in the electric light and power field as follows:—

1. Less than two-thirds of the population of the United States lives in homes which use electricity.
2. Less than 50 per cent. of the homes wired for electricity use any domestic electrical appliance except the flatiron.
3. The use of electricity in the home would be increased more than 1,000 per cent. if homes were equipped electrically throughout.
4. Less than 10 per cent. of the farms in the United States use electricity in any form.
5. Less than 1 per cent. of the entire railroad mileage of the United States is electrified.
6. The lighting of the nation's great network of highways and airways will prove a large source of new revenue.
7. Radio broadcasting, and the radio with an electric socket, have opened up a new field for consumption of energy.
8. Present use of electric power by industries is less than 50 per cent. of their actual power requirements.

The Anglo-Chinese Treaty.

Last week the text was issued of the treaty between Great Britain and China, which was signed at Nanking on December 20th. This provides, *inter alia*, for the complete national tariff autonomy of China. Each country agrees to accord most-favoured-nation treatment to the other and in the case of Great Britain this applies also to the Dominions and Colonies. The signatories also promise equality of treatment with each other's nationals for imported goods. China undertakes to procure the abolition of *likin*, or internal dues and taxes, as soon as possible.

A Radio Trade "Understanding."

A reciprocal understanding has been arrived at between the Radio Wholesalers' Federation and the Wireless Retailers' Association of Great Britain, embodying the following points, which the councils of both organisations recommend their members to observe:—(1) The W.R.A. recommends its members to give preference in purchasing to firms and companies that are members of the R.W.F. (2) The W.R.A. deprecates its members purchasing from firms and companies acting as wholesalers, but who compete with them either openly or otherwise, by selling retail as well as wholesale. (3) The W.R.A. recommends its members to communicate to the R.W.F. the name of any wholesaler or manufacturer offering radio goods at prices or on conditions other than manufacturers' listed prices and/or terms. (4) The R.W.F. agrees to circulate amongst its members, after verification, the names of applicants for trade terms who in its view do not comply with recognised trading requirements. (5) The R.W.F. recommends its members to use their influence with their retail customers to induce them to become members of the W.R.A.

The Radio Wholesalers' Federation has sent us a list of its members arranged according to towns.

Inspection of Companies in Spain.

A decree of the Spanish Finance Ministry appeared in the Official Gazette of December 30th, by virtue of which the State will have the right of inspection of all undertakings and companies established in Spain.—*Reuter* (Madrid).

For Sale.

Gillingham Corporation has for sale one Diesel engine and alternator, and the Weald Electricity Supply Co., Ltd., two gas engines, one oil engine, &c. Derby Corporation has for sale one 2,000-kW set with auxiliaries, and one 750-kW set. Mr. H. J. Shaw will offer by auction on January 9th, at 13, High Holborn, W.C.1, stocks of wireless sets, electrical goods, lamps, &c. (See our advertisement pages to-day.)

Electric Furnace Agreement.

The Metropolitan-Vickers Electrical Co., Ltd., and the Electric Furnace Co., Ltd. (who are sole licensees for the British Ajax-Northrup patents) have entered into an agreement whereby each company has the right to manufacture and supply coreless induction furnaces incorporating the Ajax-Northrup and Metropolitan-Vickers patents.

Wages in the Cable-making Industry.

The stabilisation of wages in the electricity supply industry for the whole of the current year applies equally to plumber-jointers, jointers and jointers' mates in the electric cable-making industry. Two areas are excepted from this stabilisation, *viz.*, Area No. 1, North-East Coast, and Area No. 10, Greater London (for plumber-jointers and their mates).

The D.O.T. and Standard Fittings.

The Department of Overseas Trade is compiling a list of British firms which are at present manufacturing lampholders, conduits, and conduit fittings in accordance with B.E.S.A. specifications. The Department wishes to obtain particulars from British manufacturers of any of the above goods. Reference B.X. 4961 should be quoted in any communication.

Book Notices.

The "Practical Engineer" Electrical Pocket Book and Diary, 1929. Edited by Conrad Arnold, A.M.I.E.E. Pp. cxx +651; illustrated. London: Humphrey Milford. Price 2s. 6d. net.—While the 30th edition of this useful pocket book has been carefully revised as a whole, the sections on "Electric photometry and illumination" and "Electric lamps" have been recast and largely rewritten with a view to emphasising more strongly the practical aspect of illumination under modern conditions and requirements.

The "Argus" group of South African newspapers recently issued a special 48-page British Supplement. This, a copy of which we have received, contains many illustrated articles by leading public men on several phases of British activities—engineering, industry, sport, music, literature, &c. Copies can be obtained free of charge from Argus South African Newspapers, Ltd., 72-78, Fleet Street, E.C.4.

"Science Abstracts (A and B)." Vol. XXXI. Part 12. London: E. & F. N. Spon, Ltd. Price 3s. each.

Unemployment.

During the week ended December 17th there was a decrease of 49,810 in the number of registered unemployed. The total at that date was 1,271,100, as compared with 1,320,910 on December 10th and 1,100,050 on December 19th, 1927.

The British Mission in Australia.

In the month of November, according to the *Industrial Australian and Mining Standard*, the members of the British Economic Delegation conferred in Melbourne with representatives of the Chamber of Commerce, associated banks, Chamber of Manufactures, and other commercial institutions. They also had a conference with representatives of primary producers. The conference with the associated banking interests was attended by the general managers from the head offices of banks in Melbourne. A full and frank discussion took place with representatives of the manufacturing interests. Sir Arthur Duckham said he found the discussions very interesting, and they were characterised by an atmosphere of helpful frankness.

Trade Announcements.

As Mr. J. SCRIVENER's future business activities make it impossible for him to carry on Volta, Ltd., in its present form, the company is being voluntarily liquidated as at December 31st. Arrangements have been made for the liquidator, Mr. Norman Smith (Smith & Earle, 80, Finsbury Pavement, E.C.2), to carry on for at least twelve months, and he is retaining several of the staff of the company, as well as the warehouse at Eagle Street, where stocks of "Volta" vacuum cleaners are available. Mr. Smith will be in a position to deal with all questions of repairs, new business, and so on until other arrangements are made. For the present all correspondence should be addressed to Volta, Ltd., Kern House, 36-38, Kingsway, London, W.C.2.

Mr. L. E. HEMBER, electrical engineer, has opened new showroom premises at 4, Pepper Street, Lymm, Cheshire.

The Liverpool branch of PHILIPS LAMPS, LTD., has been removed to 25, Stanley Street, Liverpool.

Mr. W. S. JOHNSON, Edinburgh, has discontinued business on his own account and has joined Messrs. SINCLAIR, CAMPBELL AND KINGHORN, who are opening an electrical department and fittings showroom at 59-61, George Street, Edinburgh.

Mr. ERIC MARX, who has commenced business as a wholesale electrical supplier at 34-36, Oxford Street, London, W.1, wishes to receive manufacturers' catalogues.

Mr. CHRISTOPHER WADE, of Messrs, Gabriel Wade & English, Ltd., has removed from Ashburnham Road to 32, Linden Road, Bedford. His telephone number, Bedford 3187, is unchanged.

A "Venner" Gift.

We have received from VENNER TIME SWITCHES, LTD., a very serviceable thermometer. It is accompanied by a card bearing greetings conveyed in verse and epigram which, we regret to say, contain one or two rather unforgiveable—if not venerable—puns.

Company Liquidation.

RADIO MAINTENANCE, LTD.—A meeting of creditors was held on December 28th, at 15, King Street, St. James, S.W.

Prices of Raw Materials.

Messrs. F. Smith & Co. report, December 31st:—Copper (electrolytic) bars, £77 10s., £2 5s. inc.; ditto ditto sheets, no change; ditto ditto wire rods, £87 10s., £2 5s. inc.; ditto ditto h.c. wire, 10 13/16d., ¼d. inc.; Silicium bronze wire, 11¼d., ¼d. inc.

Messrs. James & Shakespeare report, December 31st:—Copper bars (best selected), sheet and rod, £100, £2 inc.; English pig lead, £23 5s., 15s. inc.

Messrs. Edward Till & Co. report, December 31st:—No change in the price of india rubber, Para fine.

Lighting and Power Notes.

Afghanistan.—WATER POWER.—One of *Reuter's* correspondents in India reports, in connection with the fighting now proceeding between Afghan Government troops and insurgents, that the Salang River, which is used to provide hydro-electric power for Kabul, has been diverted by the rebels into another channel, and the consequent failure of electricity has caused much inconvenience in the Government factories.

Aylesbury.—ELECTRICITY IN BULK.—The Town Council has accepted an offer of a temporary bulk supply of electricity from the Central Electricity Board. The Council is to provide a demand of not less than 1,000 kW. The Council has adopted a scheme for carrying out within the next twelve months h.p. and l.p. lines and works in the rural areas at a cost of £16,000.

Birkenhead.—LOANS.—The Corporation Electricity Committee has obtained sanction to the borrowing of £3,582 for mains, £11,200 for rotary convertor equipment, £666 for transformers, and £2,730 for switchgear.

Brampton.—ELECTRICITY SUPPLY.—The Rural District Council has received from the Carlisle Corporation a letter with regard to the proposed extension of the electricity supply to the area, asking whether the Council is desirous of taking a bulk supply and acting as distributors, or whether it would be willing for the Corporation, or, as an alternative, for a private company to carry out the distribution. A deputation has been formed to discuss the matter with the City Electricity Committee and report.

Canada.—QUEENSTON-CHIPPAWA EXTENSION.—The Hydro-Electric Power Commission of Ontario has decided to add a tenth unit to its power plant at Queenston, Ontario. This will add 65,000 h.p. to the capacity of this power plant, bringing the total installed capacity up to 625,000 h.p. The cost of the addition will be approximately $4,000,000. Although originally designed for nine sets, it has been demonstrated that there is a sufficient flow of water in the canal from Chippawa creek to operate the extra set. While no additional work will be required on the canal itself, it will probably be necessary to enlarge the forebay on the north side and put in an additional penstock.

NEW WINNIPEG HYDRO-ELECTRIC PLANT.—With the completion of a 14-mile railroad from Whitemouth, Manitoba, to Seven Sisters Falls, on the Winnipeg River, work will begin at once on the 135,000-h.p. plant that the Winnipeg Electric Company is to build there on its leased site. The company states that the sale of the entire output of the plant is already assured, that it will be completed in two or three years at a cost of approximately $20,000,000, and that its capacity will ultimately be raised to 230,000 h.p.

Continental.—FRANCE.—An amalgamation of rural electricity supply undertakings is being effected by the Société L'Union Electrique Rurale which is acquiring the undertakings of the Société Centrale de Distribution d'Energie, the Société Française d'Electrification Rurale, the Société le Morivan Electriques, and the Société d'Eclairage et de Force Motrice de la Region du Vernet-la-Varenne. The capital of the Rurale Co. is being increased from 10 to 32 million francs.

GERMANY.—Up to 1916 the largest power station in Germany was that at Golpa, with a capacity of 128,000 kW, but since the war this has been passed by the Goldenburg plant of the Rhenish-Westphalian Electricity Co., with a capacity of 290,000 kW. The Golpa station, however, is to be further extended, and the capacity of the plant increased to 430,000 kW. It is claimed that when the extensions are completed it will be the largest power station in the world. The new plant will be noteworthy for the size of the generating units. The original plant comprised turbo-generators of 16,000 kW capacity, whereas for the latest extension a contract has been placed with the Allgemeine Elektricitäts Gesellschaft of Berlin, for a 85,000-kW turbo-generator set.

Dereham.—INAUGURATION OF SUPPLY.—An electricity supply for the district was recently formally inaugurated by the chairman of the Urban District Council. The supply is obtained from Norwich Corporation and distributed by the Council.

Derby.—INQUIRY.—A Ministry of Transport inquiry was held recently by Mr. A. D Erskine, respecting the application of the Leicestershire and Warwickshire Electric Power Co., to erect 13 poles at Melbourne for the supply of electricity. For the company it was urged that it would be uneconomical to place the line underground, and although it was admitted that in Melbourne itself a large proportion of the existing lines were underground, it was explained that when the company took over the undertaking from a local private company the ducts had already been laid. The County Council opposed on the ground that for the safety of the public it was undesirable to have additional poles put up on the highways. The assistant chief constable said that during the last five years there had been 279 accidents in the county to motor vehicles through collisions with telegraph poles, lamp standards and other obstructions. It was also urged that poles would not add to the beauty of the district.

Douglas (I. of M.).—EXTENSION OF SUPPLY.—The Town Council, on December 18th, presented to the Tynwald a petition for leave to extend the optional area for the supply of electricity to certain districts outside the borough. The area which the Council wishes to include is that in which the Howstrake Estate Co. is empowered to lay mains, an area vested in the Manx Electric Railway Co. The application is being opposed, and the Tynwald has referred the matter to a committee.

Droxford.—ELECTRICITY SUPPLY.—The Rural District Council has received from the West Hampshire Electricity Co., Ltd., an intimation that it proposes to apply for a Special Order to distribute electricity in an area including the Droxford rural district, with the exception of the parish of Hambledon, and that it is proposed to obtain a supply of electricity in bulk from the Southampton Corporation.

Godalming. — PRICE REDUCTIONS. — The Urban Electric Supply Co. has reduced the charge for electricity for lighting from 10d. to 9d. per kWh, and has made a flat rate of 3½d. per kWh for power and heating.

Guildford.—INQUIRY.—The Electricity Commissioners have appointed Colonel T. C. Ekin to hold an inquiry at the Ayers' Hall on January 15th into the following orders: Aldershot District Electricity (Extension) No. 1, No. 2, and No. 3 Special Orders; Petersfield Electricity (Extension) Special Order; West Sussex Electricity Special Order; Steyning Electricity (Extension) Special Order; and Alton Electricity (Extension) Special Order.

Holbeach.—INQUIRY.—Colonel F. Gordon Tucker held a Ministry of Transport inquiry on December 20th respecting objections to the erection of poles for h.p. cables to the Holbeach, Long Sutton, and Sutton Bridge districts, by the Boston Electricity Supply Co., Ltd. The line is to carry a pressure of 11,000 V, and as it was to traverse rich arable land it had been designed at considerable additional expense to follow hedge-lines as far as possible. Originally there were eight objectors, but these had been reduced to six. In one case it was suggested that the line might be diverted *via* a roadway, but Colonel Tucker said the Ministry would not agree to h.p. cable on a roadway. It was also asked why the cables could not be placed underground. Colonel Tucker explained that the cost would be three times as much, and the company could not supply Sutton Bridge with electricity at a low cost. As a result of the inquiry several objections were disposed of.

Ilford.—LOAN.—The Corporation Electricity Committee is to apply for sanction to a loan of £5,000 for the free wiring scheme.

Japan.—ELECTRICAL DEVELOPMENT.—The capacity of electrical plant to be installed in Japan during the current year is 340,000 kW, of which 230,000 kW will be installed in hydro-electric power stations and 110,000 kW in steam power stations. At the end of the year the plant installed will total 4,020,000 kW.

Keighley.—NEW PLANT.—The Corporation Electricity Committee has recommended the installation of a new water-tube boiler, &c., and that application be made for sanction to a loan of £8,000 for this purpose.

Kingston.—LOANS SANCTIONED.—The Electricity Commissioners have sanctioned the borrowing by the Town Council of £4,695 for mains, £2,401 for plant, and £7,251 for works consequent upon change of system.

Lichfield.—LOANS.—The Town Council has received sanction to loans of £4,100 in connection with the extension of the mains to Whittington, and £4,407 for excess expenditure. A loan of £2,850 has been applied for for extending the mains to Shenstone.

London.—BATTERSEA.—The Borough Council Electricity Committee is to install electricity services in 125 premises, at a cost of £1,171, extend mains for private services at a cost of £866, and extend mains for public lighting at a cost of £344.

Morocco. — HYDRO-ELECTRIC DEVELOPMENT. — The hydro-electric station which is under construction at Sidi-Said-Machou, about 53 miles from Casablanca, is nearing completion. The works consist of a dam, a tunnel of 4,675 ft., cutting off a loop of eight miles from the Oum-er-Rebia river, and a power station at the mouth of the tunnel. It is estimated that the dam will utilise a head of 11½ ft. of water and allow a maximum flow through the sluicegates and over the spillway of 1,188,799 gal. per sec. The installation should have been finished by the end of 1928, but owing to difficulties in obtaining the necessary labour, the station will not be put into operation until about the beginning of March next. Two turbines will then be in operation, and the other two are expected to be completed by the end of January, 1930. Three turbines will function normally, a fourth will be used as a reserve only, and the average power developed will be 20,000 h.p.

Newton Abbot.—NEW SUB-STATION.—The erection of the new 2,000-V sub-station was completed on December 22nd, and the station was put into commission the following day. The station will supply the growing suburb of Milber, on the outskirts of the town.

Norwich.—LOANS.—The Corporation Electricity Committee has recommended that application be made for sanction to the following loans: £12,264 for excess expenditure on Thorpe power station; £100,000 for prospective unspecified expenditure on mains and services; £10,000 for transformers; and £5,000 for extensions to offices and workshops at Duke Street.

Pontefract.—INQUIRY.—At the request of the Town Council and the Chamber of Commerce, the Electricity Commissioners have appointed Col. T. C. Ekin to hold an inquiry at Pontefract on January 8th into the alleged excessive charges made by the West Riding Tramways Co., Ltd., for electricity within the borough.

Preston.—LOANS SANCTIONED.—The Corporation has received sanction to a loan of £46,000 for the modification of certain generating plant already installed or under construction, so as to increase the capacity of the Ribble station from 50,000 kW to 60,000 kW. The Electricity Commissioners have also sanctioned a loan of £3,500 for the purchase of property adjoining the Crown Street works.

Réunion.—HYDRO-ELECTRIC INVESTIGATION.—A commission of French electrical engineers is at present in Réunion reporting on the project for the utilisation of the water power available on the island. It is stated that the River Marsouins can furnish power to the extent of 25,000 kW at low water and 40,000 kW in flood periods. The necessary plant for the hydro-electric power station is to be supplied by Germany on war reparations account.

Shoeburyness.—LOAN SANCTIONED.—The Urban District Council has received sanction to a loan of £6,644 for carrying out an electric lighting scheme for the town.

Stoke-on-Trent.—ELECTRICITY SUPPLY.—At a recent meeting of the Corporation Electricity Committee a letter was received from Messrs. Alfred Meakin (Tunstall), Ltd., stating that they had in contemplation the erection of an electrical kiln at their Newfield factory. It was decided that the three-phase e.h.p. main be extended to Newfield Pottery, and that application should be made for sanction to borrow £2,400 for this purpose.

Taunton.—LOAN.—The Town Council has applied for sanction to a loan of £3,000 for meters for the next three years. A scheme for wiring houses on the hire system has been adopted.

United States.—ELECTRICAL DEVELOPMENT.—According to the *Electrical World*, the Utilities Power and Light Corporation of Chicago announces that it will immediately build a steam-electric generating station at Sayreville, N.J., to be owned and operated by its subsidiary, the Eastern New Jersey Power Company. The plant will cost $6,000,000 and will have an initial capacity of 60,000 kW, derived from two 30,000-kW turbo-generators. This capacity will be increased to 180,000 kW in steps of 30,000 kW as the demands for power require its expansion. There will be a coal storage capacity of 60,000 tons. The site adjoins the main channel of the Raritan River, which there has a depth of 15 ft. at low water, permitting coal to be delivered either by water or rail.

West Ham.—LOAN.—The Town Council is to apply for sanction to a loan of £69,300 for the laying of h.p. feeder cables direct from the generating station to the London County Council pumping station, and sub-station equipment.

Tramway and Railway Notes.

Bradford.—RAILLESS CARS.—The Corporation Tramways Committee has recommended the purchase of eleven single-deck and six double-deck railless cars.

Glasgow.—INQUIRY.—The Electricity Commission inquiry into the application by the Corporation for power to install new plant at Pinkston power station will take place on January 29th. It was to have been held on December 18th last, but was delayed owing to the illness of one of the counsel.

Japan.—ELECTRIC RAILWAYS.—The Railway Department reports that on October 1st last there were 92 electric railways in operation in Japan, with an aggregate mileage of 1,218, and 40 others in course of construction, with a total mileage of 134. In addition, 51 charters had been granted for the construction of electric railways, totalling 356 miles, one elevated railway with a length of 20 miles, and two underground railways with an aggregate mileage of 15.

London.—COLLISION.—Traffic was delayed on the Southern Railway on December 27th due to the derailing of one coach of an electric train which came into collision with an empty van train. The Southern Railway issued the following official statement:—"An empty van train slightly touched an electric train, and one of the coaches of the electric train was derailed. It knocked down an overhead girder on the electric system, and another train collided with the girder. The result was that the central section of London Bridge station was closed for about 1½ hours, and electric trains on the central section (the Brighton side) were terminated at New Cross and Peckham Rye. Some trains were diverted to Victoria and others to Charing Cross. The eastern side of London Bridge was not affected. No one was hurt, and no serious damage done."

United States.—RAILWAY ELECTRIFICATION.—The *Electrical World* reports that on December 4th the Great Northern Railway began electrical operation of the entire 80-mile stretch of its main line between Skykomish and Wenatchee, Wash., with the exception of about 10 miles through the new tunnel in the Cascade Mountains. This tunnel is to be opened about January 12th, and after that date the whole 80 miles will be operated by electricity. For eighteen months the Great Northern has been working upon the conversion of the Skykomish-Wenatchee line, and in recent months it has hauled its trains over about 30 miles with electric locomotives.

Telegraph and Telephone Notes.

Australia.—RADIO STATION FIRE.—The costly equipment of the "beam" wireless-telegraph station at Ballan, about 50 miles from Melbourne, narrowly escaped destruction on December 28th, when the roof of the engine-room was destroyed by fire. The fire-fighting equipment of the station proved inadequate, and until the arrival of the fire-engine from Ballarat, two hours after the fire broke out, little could be done to check the blaze, says *The Times*. The fire burned for three or four hours and damaged the generators. It is understood that the transmitter at Ballan was severely damaged by fire and water, and that it will not be available for service for some days. The service is being maintained through the international broadcasting transmitter at Pennant Hills, Sydney, which is being controlled by a land line, 500 miles long, from Melbourne. This station only maintains one circuit, so that simultaneous transmission to Canada and Great Britain is impossible, but the cables will assist to relieve the congestion. The British Broadcasting Corporation's proposed attempt to relay New Year greetings from Australia to listeners in the British Isles had to be abandoned because of the dislocation of the service caused by the fire.

RADIO STATIONS SALE.—The Governor-General, in Council, has approved of the sale to Amalgamated Wireless (Australasia), Ltd., for £39,574 of 25 Government wireless-telegraph stations, which have been operated for the Commonwealth by the company for some time past.

Isle of Man.—RADIO COMMUNICATION.—Wireless communication with the Isle of Man was established on December 29th by the Post Office authorities on two routes between the mainland and Douglas. The service was organised to supplant the submarine telegraph cable, which, for some time, has been yielding unsatisfactory results, culminating in serious difficulty during the Christmas holidays. A wireless-telegraph station at Fleetwood, to establish temporary communication with Douglas, was housed in the hutment barracks on land belonging to the War Office. Direct wireless communication with Douglas was also instituted from the R.E. barracks in Mason Street, Liverpool.

Marine Radio-Telegraphy.—LEGISLATION POSTPONED.—The Merchant Shipping (Convention) Act, which was passed by Parliament in 1914, but has never come into force, has been postponed for another year by an Order in Council. It is now due to come into force on January 1st, 1930, but in view of the fact that many of its provisions are obsolete, and of the International Conference on Safety of Life at Sea which is to be held in London in the spring, it is unlikely that it will ever operate.

Spain.—MADRID-HAVANA WIRELESS SERVICE.—The Council of Ministers approved on December 21st of a scheme for the provision of a wireless service between Madrid and Cuba.—*Reuter* (Madrid).

Transoceanic Telephony.—HOLLAND-EAST INDIES.—A public telephone service between Holland and the Dutch East Indies will be opened on January 8th between Amsterdam, Rotterdam, Utrecht, The Hague and the four leading towns in the East Indies. Dutch Post Office officials have recently been experimentally telephoning all over the world: in addition to conversation with Sydney, New South Wales, says *The Times*, they have lately held successful conversations with South America. The incoming conversations from Sydney were transmitted *via* the Dutch East Indies, and the outgoing calls from Holland were direct from a short-wave sending station at Kootwijk. The South American station worked on 28½ metres, and the transmission from Holland on 18 2/5 metres. The new service will be the third long-distance wireless-telephone link to be established in two years. It was on January 7th, 1927, that the transatlantic service between London and New York was opened to the public. The London trunk exchange acts as the European focus of the

whole service, and that between Germany and Argentina, opened on December 10th, was at first conducted through British stations, but the service is now operated at the German end from the Nauen wireless station.

United States.—RADIO-TELEPHONY.—The construction of a $100,000 wireless transmitting station has been started at Scobeyville, N.J., by the Universal Wireless Communication Co. for commercial telephony.

Radio Notes.

Australia. — REORGANISATION.—Preliminary recommendations for the reorganisation of the broadcasting services in Australia have been submitted to the Federal Ministry by the Broadcasting Committee. The Ministry will in future provide all stations and equipment, and will lease the right to provide programmes to a single organisation. Class A station leases will be for three years, and it is unlikely that Class B stations will be increased in number, they being auxiliary and obtaining their revenue mainly from advertisement. The scheme is not expected to become effective for some months.

France.—PRIVATE STATION TRANSFER.—Owing to its unfortunate financial position, the Montpellier Radio Club's transmitter has been taken over by the P.O. authorities, says *World-Radio*. It is being installed in the post office, will have an input of 2 kW, and should re-commence operation about the middle of January, its wave-length of 253.1 m. remaining unchanged.

Oscillation.—DECLINE.—The oscillator has been rather forgotten of late, but the British Broadcasting Corporation has been on the watch, and some surprising statistics have been prepared, says the *Wireless World*, showing that oscillation has diminished considerably. From December 1st, 1927, to November 30th, 1928, some 2,037 cases of oscillation were referred by the B.B.C. to the Post Office. Of that number, 1,445 were dealt with by the Post Office engineers, and in nearly 17 per cent. of the cases the fault was found to lie in the complainant's own receiver. During the previous year the proportion was 35 per cent., but at that time only meagre details of each complaint were available. Nowadays every correspondent who complains of local oscillation receives a questionnaire in which every available detail can be tabulated. The total number of complaints dealt with by the B.B.C. during the past year was 9,006. The "curve" was at its highest in January and February, which suggests that new listeners were experiencing difficulty in operating their sets. The lowest mark was reached at holiday time in July and August. The number of anti-oscillation pamphlets issued up to the present is 822,529.

Receiving Licences.—LARGE INCREASE.—An increase of 34,706 receiving licences was registered in November, 1928, in Great Britain, the total being 2,564,516. The increase noted in November, 1927, was 18,000.

Wavelengths.—REVISION.—The allocation of the 113 available wave-lengths among European stations according to the 1925 *plan de Geneve*, framed by the Technical Committee of the Union Internationale de Radiophonie, has not been satisfactory. A new *plan de Bruxelles*, arrived at by majority agreement between the European nations and involving sacrifices by all those unduly favoured by priority in the old plan, will become effective on January 13th, 1929, and British station wave-lengths will accordingly be readjusted as follows:—

PRESENT.			NEW.		
Kilo-hertz.	Metres.	Station.	Kilo-hertz.	Metres.	Station.
192	1,562.5	Daventry 5XX	192	1,562.5	Daventry 5XX
610	491.8	,, 5GB	622	482.3	,, 5GB
740	405.4	Glasgow	748	401.1	Glasgow
780	384.6	Manchester	793	378.3	Manchester
830	361.4	London	838	358	London
850	353	Cardiff	--	—	—
920	326.1	Bournemouth	928	323.2	Cardiff
960	312.5	Newcastle	964	311.2	Aberdeen
980	306.1	Belfast	991	302.7	Belfast
1,040	288.5	Edinburgh	1,040	288.5	Relays and Bournemouth
—	—	—	1.230	243.9	Newcastle

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Army Contracts.—Manufacturers who are not already on any War Office list of tenderers, and who wish to be invited to tender for Army requirements of electrical and wireless stores, cables, electrical plant, scientific instruments, &c., should apply to the Director of Army Contracts, Caxton House (West), Tothill Street, Westminster, S.W.1, for Form 1, on which formal application for inclusion on the list of tenderers may be made.

Ashford.—January 14th. Electricity Department. One heavy-oil engine to drive a 600-kW alternator, &c. (December 21st.)

Australia.—NEW SOUTH WALES.—February 11th. Department of Public Works. Supply, delivery, erection and maintenance of hydro-electric plant in connection with the Hume Reservoir hydro-electric development. (B.X. 4989.)*

January 21st. Static transformers for Young-Wyangala section of the Burrinjuck hydro-electric development. (B.X. 4995.)

Belgium.—January 8th. Municipal authorities of Saint Gilles, Brussels. 3,320/4,150-kW steam turbo-generator for the St. Gilles power station. Particulars for 5 francs from Service de l'Electricité, 40, Rue de Bethléem, St. Gilles, Brussels.

Brentford.—BOARD OF GUARDIANS.—Installation of electric lift at the West Middlesex Hospital, Isleworth. (See this issue.)

Brentwood.—January 21st. Essex and Colchester Mental Hospital Committee. Wiring Brentwood Mental Hospital. (December 14th.)

Edinburgh.—January 14th. Electricity Supply Department. Boiler feed water de-aerating plant. (December 21st.)

January 18th. District Board of Control. Electric power and lighting installation at Gogarburn, Edinburgh. Specifications from Mr. Stewart Kaye, architect, 14, Hill Street, Edinburgh.

Egypt.—CAIRO.—January 31st. Ministry of the Interior. Diesel engine-driven d.c. generator set. d.c. rotary balancer and accessories for the Kafr El Zayat power station. (B.X. 4931.)*

January 27th. Transformer kiosks, cables and accessories for the extension of electricity supply from Mit-Ghamr power station. (B.X. 4893.)*

Glass Houghton (Yorks.).—January 14th. West Riding Education Committee. Electric lighting installation at Ashton Road Council school and caretaker's house. Specifications, &c., from Education Department, County Hall, Wakefield.

India.—NEW DELHI.—January 8th. Indian Stores Department. Three 12½-kW oil-engine-driven generator sets. (B.X. 4956.)*

January 23rd. Bombay, Baroda, and Central India Railway Co. 400-kW heavy oil engine driven generating set. Specifications from the offices, White Mansion, 91, Petty France, S.W.1 (deposit £1). (See this issue.)

February 5th. Turbo-alternator set, condenser, boiler, economiser, switchgear and cables for the new power station, Delhi. (B.X. 4944.)*

Keighley.—January 17th. Electricity Department. One water-tube boiler (30,000 lb. per hour) with mechanical stoker and superheater. (December 28th.)

Kettering.—January 14th. Electricity Department. Supply and delivery of h.p. and l.p. cables, and transformers. (See this issue.)

Liverpool.—January 31st. Corporation. Supply of various electrical materials. (See this issue.)

London.—ISLINGTON.—January 18th. Electricity Department. Materials for 12 months, including cables, meters, transformers, &c. (December 14th.)

BETHNAL GREEN.—January 14th. Borough Council. Electric lighting and power installations and telephone installation for the public baths and washhouses at Old Ford Road. (December 21st.)

February 18th. Central Electricity Board. Supply, delivery and erection of 132,000-V overhead transmission lines in connection with the Central England, and North-West England and North Wales Electricity Schemes. (See this issue.)

New Zealand.—WELLINGTON.—January 29th. Public Works Department. Single core, paper-insulated, lead-covered cable (B.X. 4954.)* 15 sets of earth leakage protection equipment. (B.X. 4950.)*

March 18th. 110,000-V transformers (B.X. 4952)*, 11,000-V switchgear (B.X. 4953.)*

January 15th. Posts and Telegraph Department. Telephone cords. (B.X. 4847.)* Vitreous-enamel phase-indicating plates (B.X. 4927.)*

February 12th. V.i.r. wire. (B.X. 4951.)*
February 19th. 120,000 galvanised steel spindles for insulators. (B.X. 4948.)*
February 12th. Dry cells for telephone work. (B.X. 4991.)*
February 28th. Telephone cordage. (B.X. 4990.)*
February 28th. Whangarei Harbour Board. One 15-ton electrically-operated level luffing gantry crane. (A.X. 7263.)*
January 31st. Manawatu-Orona Electric Power Board. Automatic reclosing switchgear for pole platform mounting. (B.X. 4988.)*

Norton.—January 14th. West Riding Education Committee. Electric lighting installation at the new school. Specifications, &c., from Education Department, County Hall, Wakefield.

Ripon.—February 1st. Corporation. Works in connection with the proposed electricity supply undertaking as follows:—Contract No. 2: Overhead 11,000-V transmission line. (See this issue.)

Rumania.—January 10th. Ministry of Communications. 17,000 insulators, iron, steel, copper and bronze wire and 11,000 copper coupling rings. (A.X. 7289.)*

South Africa. — JOHANNESBURG. — January 24th. South African Railways and Harbours. Two small d.c. crude-oil generating sets for Maguassi. (B.X. 4943.)*
February 14th. One 15-ton electrically-driven portal titan crane. (A.X. 7272.)*
January 24th. Town Council. Electric cable. (B.X. 4977.)*
January 24th. Oil switches. (B.X. 4994.)*
CAPE TOWN.—January 23rd. City Council. Electric cable. (B.X. 4978.)*

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Bolton.—Tramways Committee. Accepted:—
Special crossings, &c.—Hadfields, Ltd.

Brentford.—Board of Guardians. Accepted:—
Intercommunication telephone installation at Warkworth House, Toolands House, and West Middlesex Hospital (£1,115); rewiring the radio installation at the hospital (£100).—Reliance Telephone Co., Ltd.

Chelmsford.—Watch Committee. Recommended:—
Street signal fire alarm system (£257).—Carter & Co.

Ilford.—Electricity Committee. Accepted:—
1,000-kW convertor (£3,235).—Crompton Parkinson, Ltd.
200-kVA transformer (£144).—Foster Engineering Co., Ltd.
Tramways Committee. Recommended:—
New cells for electric tower wagon (£147).—A.F.A. Accumulators, Ltd.
Trolley wire (10 5/8d. per lb.).—British Insulated Cables, Ltd.

Dover.—Electricity Committee. Accepted:—
Switchgear (£640).—Switchgear & Cowans, Ltd.
6,600-V feeder cable (£2,232).—Pirelli-General Cable Works, Ltd.

Essex.—County Health Committee. Recommended:—
Wireless installation at Harold Court Sanatorium (£107).—Chelmsford Radio Co.

Leeds.—Electricity Committee. Accepted:—
Cables.—W. T. Henley's Telegraph Works Co., Ltd. (£865); Enfield Cable Works, Ltd. (£1,553); Macintosh Cable Co., Ltd. (£1,178); Greenwich Cable Works, Ltd. (£2,315).
Terra-cotta work for work at Kirkstall power station.—Leeds Fireclay Co., Ltd. (£18,942).
Extension of tram depôt in Swinegate.—Lift and enclosure.—A. P. Steven, Ltd. (£703).

Manchester.—Cleansing Committee. Accepted:—
Electric lighting, Oldham Road depôt.—E. M. Evans and Son, Ltd.
Education Committee. Accepted:—
Electric lighting installation at Johnson Street clinic.—A. Louden.
Electric lighting installation at Plymouth Grove centre and Princes Street Buildings, and alterations to electric lighting installation at Cambrian Street school.—R. Seddon & Sons.

Rugby.—Urban District Council. Accepted:—
Cables (£332).—W. T. Henley's Telegraph Works Co., Ltd.

Sheffield.—Electricity Committee. Accepted:—
Concrete tank foundations, retaining wall, pipework, &c., for new cooling tower at Neepsend power station.—James Laver & Sons, Ltd. (£3,524).
Tramways Committee. Accepted:—
500 tramcar tires (£3 6s. 3d. each).—Cammell, Laird and Co., Ltd.

Smethwick.—Education Committee. Accepted:—
Electric fittings at open air school.—Walker & Co. (£96).

Wimbledon.—Electricity Committee. Recommended:—
Pipework for boiler.—Babcock & Wilcox, Ltd. (£374).
Two 4-circuit equipments.—English Electric Co., Ltd. (£202).
Twenty-eight 400/500-amp. l.p. equipments.—George Ellison (£412).
Two 100-kVA transformers.—Foster Engineering Co., Ltd. (£158).
Two 200-kVA transformers.—Hackbridge Electric Construction Co., Ltd. (£237).

Forthcoming Events.

Institution of Mechanical Engineers (Informal Meeting).—Friday, January 4th. Institution, Storey's Gate, S.W. 7 p.m. "The Engineer Salesman Abroad." Major A. W. Farrer.

Royal Institution of Great Britain.—Saturday, January 5th, and Tuesday, January 8th. Institution of Electrical Engineers, Savoy Place, W.C.1. 3 p.m. "Sound Waves and their Uses." Mr. A. Wood.

Exhibition of Industrial Electric Heating Apparatus.—January 7th to 12th. Belle Vue, Longsight, Manchester.

Electrical Power Engineers' Association (London Local Group).—Tuesday, January 8th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "Domestic Electrical Appliances, Design, Construction and Efficiency."

Physical Society and Optical Society.—Annual Exhibition of Electrical, Optical and other Physical Apparatus. January 8th to 10th. Imperial College of Science, South Kensington, S.W.

Institute of Wireless Technology.—Wednesday, January 9th. Engineers' Club, Coventry Street, W. 7 p.m. "Picture Transmission." Mr. J. Friechenfried.

Institution of Electrical Engineers.—Thursday, January 10th. Institution, London, W.C. 6 p.m. "A Study of the Future Development of Demand and the Economic Selection, Provision and Lay-out of Plant, as Illustrated by Telephone Systems on the one hand and Power Stations on the other." Capt. J. M. Donaldson and Capt. J. G. Hines.

(Mersey and North Wales (Liverpool) Centre).—Monday, January 7th. University, Liverpool. 7 p.m. "Overhead Electric Lines." Mr. W. B. Woodhouse.

(North-Western Centre).—Tuesday, January 8th. Engineers' Club, Manchester. 7 p.m. "Recent Developments in Electricity Meters, with particular reference to those for special purposes." Mr. J. L. Carr.

(Scottish Centre).—Tuesday, January 8th. Royal Technical College, Glasgow. 7.30 p.m. "The Electrical Equipment of X-ray Apparatus." Mr. L. G. H. Sarsfield.

(Dundee Local Section).—Thursday, January 10th. University College, Dundee. 7.30 p.m. "Static Rectifiers." Mr. W. M. Mackay.

(Meter and Instrument Section).—Friday, January 4th. Institution, London, W.C. 7 p.m. "Precautions in the Use of Standard Instruments." Mr. W. H. Lawes.

(London Students' Section).—Friday, January 11th. Institution, London, W.C. 6.15 p.m. "Telephone Repeaters." Mr. J. A. H. Lloyd.

(North-Eastern Students' Section).—Friday, January 11th. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. "Some Problems in the Design of Pilot Wire Protective Systems." Mr. E. W. M. Scott.

Association of Mining Electrical Engineers (Western Sub-Branch).—Saturday, January 12th. 60, Wind Street, Swansea. "Cables and Control Gear for use Underground." Mr. G. Rutter.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

CRESCENT meters.
PELLEN radiators.
UNIVERSAL imitation glow fires.
UNIVERSAL battery charging clips.

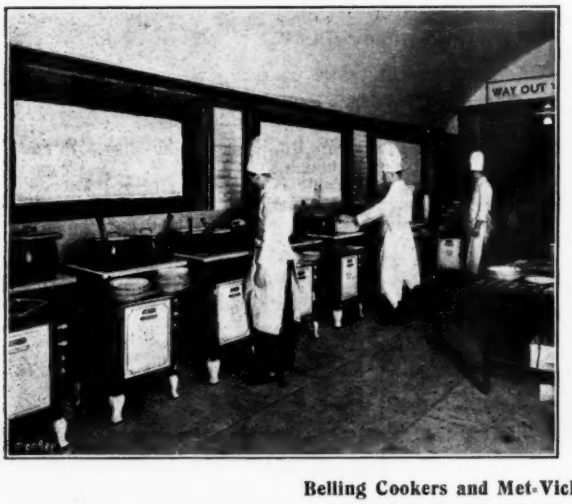
Notes.

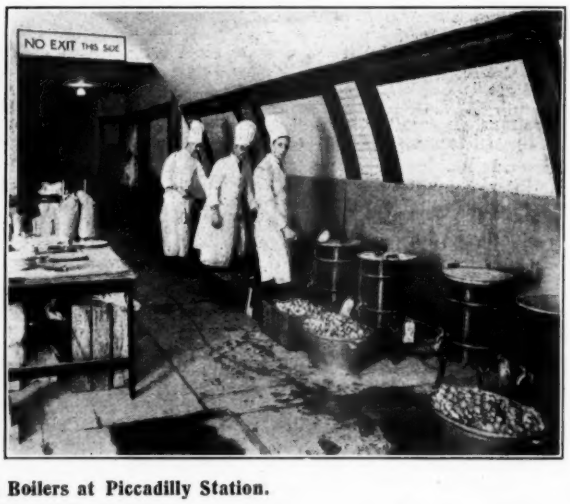
Traffic Control.

Coventry Corporation is giving a trial to an electrical system for the control of traffic by means of automatically operated coloured lights. An installation has been made where the main Birmingham-London road crosses one of the principal thoroughfares of the city. The lamps are placed on posts at each of the four corners, and show a red light for "stop," amber for "caution," and green for "go on." When the red light stops traffic in one direction the green light gives the signal for the crossing traffic to proceed, with a short amber light display before each change. The object of the system is to relieve police constables of point duty, it being claimed that the service can be maintained at a cost of £10 per annum, whereas a point-duty constable costs £400. The trial was begun on December 17th, when it was found that the 20 seconds' period for the red and green lights was too short, and this was doubled with more satisfactory results.

An Emergency Cooking Installation.

Just before the recent opening of the new Piccadilly Station of the London Underground Railways (ELECTRICAL REVIEW, December 14th, 1928), it was decided to give a dinner to all the men engaged upon the work. Electric cooking was decided on for obvious reasons, and Messrs. BELLING & Co. supplied the necessary cookers. Ten of the No. 6 cookers were used, as shown below, each being equipped with an oven 14½ in. high by 13½ in. wide by 14 in. deep, and two enclosed-type fireclay boiling plates, each 8 in. square. The meal consisted of fried fish and fried potatoes, roast beef, boiled potatoes and brussels sprouts, and Christmas pudding. In addition to the cookers a number of electric boilers were employed. They were supplied by the METRO-VICK SUPPLIES, LTD. Two hundred and eighty-seven persons sat down to the meal, and we understand that the excellent quality of the food was commented upon and largely attributed to the cookers.





Belling Cookers and Met-Vick Boilers at Piccadilly Station.

French Rural Electrification.

Great interest has been taken since the 1914-18 European war in the electrification of rural districts in France, and it is not perhaps generally realised what great efforts have been made and how much work has been accomplished in this direction. The French Government has realised to the full the importance of the work and has not been niggardly with the subventions and long-term loans it has granted: in 1920 it granted subventions to the amount of 3½ million francs; in every succeeding year the amount increased until in 1927 it was 150 millions, and in 1928 it reached 180 million francs; long-term loans granted in accordance with the law of August, 1923, total 172 million francs. Taking subventions and loans together, no less than nearly 700 million francs has been granted by the Government, the rest of the total of 2,000 million francs spent on electrification work having been supplied by the departments, communes, farmers interested, and companies holding concessions. At the end of the war in 1918 only 7,000 communes were supplied with electricity: on December 31st, 1927, out of 37,981 communes no fewer than 21,234 were electrified, which represents 55 per cent. of the total number of communes with a population of 32,784,365, or 80 per cent. of the total population of France; in 1927 power systems were installed in over 3,000 communes. Mr. Tardieu, Minister of Public Works, was apparently not exaggerating when he said at the opening of the Puyvalador barrage that if this pace continued, at the end of six years every French village would be electrified.—*Reuter's Trade Service* (Paris).

The Whitworth Society.

The sixth annual commemoration dinner was held at the Holborn Restaurant, London, on Friday, December 21st, with the president, Mr. F. H. Livens, J.P., in the chair. Mr. W. H. Fowler, M.Inst.C.E., Manchester, was elected president for 1929, and will take office at the summer meeting to be held in Manchester next July, during the meeting of the Institution of Mechanical Engineers. It was decided that the date for holding the annual commemoration dinner should be altered, and the next dinner will be held in March, 1930. Six of the scholars of the current year were present as guests, and each was presented with a copy of "The Whitworth Book." Further particulars may be obtained from the hon. secretary, the Whitworth Society, c/o the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1.

Submarine Power Cables in the United States.

A correspondent of *The Times Trade and Engineering Supplement* states that the Interstate Public Service Company recently completed the laying and putting into service of two 15,000-volt submarine cables across the Ohio River, interconnecting the systems of that company and the Louisville Gas and Electric Company. Each cable is a three-conductor 250,000-cir. mil cable, and has the usual lead covering, jute filler, and galvanised steel armour, the over-all diameter of the cable being 2.92 in. and the weight, approximately, 14 lb. per foot. Each was made up and shipped in two 1,400-ft. lengths, and the splices were made while the barge upon which the cable reels were mounted was anchored in mid-stream.

Hackney Technical Institute.

ELECTRICAL ENGINEERING DEPARTMENT.—A short course of about 12 lectures commencing on Thursday, January 10th, will be given at the Hackney Technical Institute on the following subjects: on "Modern Developments in Protective Apparatus," at 6.30 p.m., on "Automatic Control Gear," at 8.10 p.m. Full particulars can be obtained from the Principal at the Institute.

The Boulder Canyon Project, U.S.A.

Commenting on a report of a board of engineers and geologists appointed by the Secretary of the Interior, U.S.A., to examine the proposed site of a dam on the Colorado River at Black Canyon, or Boulder Canyon, *Electrical News Items* quotes the Board as stating that the proposed dam would be by far the highest yet constructed, and would impound 26,000,000 acre-feet of water. If it should fail, the flood created would probably destroy several townships and the levees of the Imperial District, creating a channel into Salton Sea which would probably be so deep that it would be impracticable to re-establish the Colorado River in its normal course. To avoid such possibilities the proposed dam should be constructed on conservative lines. The estimates of the cost of the project as made by the United States Reclamation Service, amounting to $125,000,000, have been revised by the Board as follows:—

Dam and reservoir	$70,600,000
1,000,000 h.p. development	38,200,000
The All-American Canal	38,500,000
Interest during construction	17,700,000
Total	$165,000,000

It is believed that under present conditions of irrigation a continuous output of 550,000 h.p., or one million h.p. on a 55 per cent. load factor, could be maintained even during the years of normal low flow. A fairly rapid irrigation development is, however, to be expected in the entire Colorado River basin, and as the use of water for irrigation increases, the amount of water available for power will decrease. The Board is of the opinion that if the Boulder Canyon project is completed and put in operation, carrying as it does the costs of

flood protection works and the All-American Canal, it will be impossible to meet operation, maintenance, interest, and a sufficient sinking fund to retire the cost of the project within a 50-year period.

The British Association.

According to *Nature*, members of the British Association who are attending this year's meeting in South Africa will leave Southampton on July 5th, arriving at Capetown on the 22nd. The inaugural meeting will be held on the evening of that day in the City Hall, when the Association will receive an official welcome from the Mayor. The sections will meet in Capetown from July 23rd to 26th and, later, the members will proceed in two parties to Johannesburg, arriving on July 30th and 31st. The Johannesburg section will continue until August 3rd. Some of the addresses of the presidents of sections will be delivered in Capetown and the others, including that of the president of Section G.—Engineering, will be given in Johannesburg. An excellent series of tours has been arranged. Members will leave Capetown on August 7th, arriving at Southampton on the 26th.

The Resistivity of Aluminium.

A meeting was held at the Laboratoire Central d'Electricité, Paris, on November 16th, to consider proposals for the values of the electrical and other qualities of aluminium for transmission lines for recommendation to the International Electrotechnical Commission for adoption. Professor Paul Janet, Director of the Laboratoire Central d'Electricité, presided, and twelve delegates were present, Great Britain being represented by Dr. E. H. Rayner (National Physical Laboratory) and Mr. E. T. Painton (British Aluminium Co.).

The subject has been under consideration for some years, information having been interchanged on a large number of experimental determinations made at the chief national laboratories of the resistivity, density, and other qualities of both hard-drawn and annealed material.

The type of aluminium considered was restricted to hard-drawn material in the form of wire. Annealing usually results in a lowering of resistance of more than 1 per cent. It was decided that it was of first importance to prescribe an upper limit of resistivity with which all commercial supplies of aluminium should comply, as the presence of impurities, if they exceed about 0.5 per cent., is liable to increase the tendency to corrosion; since increase in impurity is accompanied by an increase of resistivity, a limit to the resistivity permissible serves as a limit to the risk of corrosion. It is also necessary to define "hard-drawn" since resistivity increases with increased strength such as would be obtained by cold working, and in consequence resistivity standards must refer to a well-defined range of tensile strength. Agreement was reached on the following lines:—

The resistivity of commercial hard-drawn aluminium wire at 20 deg. C. is not to exceed 2,873 microhm-centimetres. This is to apply to wire before being stranded into a cable; if the wire is tested after having been stranded, an increase of 1 per cent. of the above value is permitted. The wire is required to withstand for one minute a stress of 16 kilograms per square millimetre. The density of aluminium is assumed to be 2.706 at 20 deg. C. The temperature coefficient of linear expansion is 23×10^{-6}. The temperature coefficient of resistance is 0.004.

It was considered desirable to adopt a definite nominal value for the resistance of commercial aluminium, which could be used in designing transmission lines; it would naturally be less than the maximum mentioned above. It was thought that this should be the average value of good material as at present manufactured. In order to obtain information on which such a value might be founded, it was decided to postpone a decision on the subject until after March, 1929, and that in the meantime the countries interested should send the necessary information to the Central Office of the International Electrotechnical Commission.

A Swiss-German Complication.

The erection of the new hydro-electric station at Klingau, in Argovie, has been the subject of much controversy, not only between the Canton and the Confederation, but also between the Swiss themselves. The Canton of Argovie had taken up negotiations with a Westphalian electric company, whereby it was agreed that the latter should aid in the setting-up of the power-station at the junction of the Aar and the Rhine. At first it was stipulated that the Germans should pay half the expenses of installing the plant, and that in return the Forces Motrices of the Rhine and Westphalia should use all the current. But before the protests of other Argovians the authorities were forced to modify their plans, all the more because permission to export Swiss energy must be obtained from the Federal Council, and the Argovian State Council shrewdly suspected that the Government would refuse a permit under the form first conceived. A new arrangement was therefore proposed to the German company. The F.M.R.W. was only to supply 40 per cent. of the cash necessary to set up the works at Klingau, Argovie would find 50 per cent., and a Swiss bank would furnish 10 per cent. Even this, however, did not altogether please, as it appeared that the bank in question was also lending the German company the capital necessary for its participation in the work, and that, once the latter was in full blast, the Westphalians were to have all the electric energy of Klingau, for a period of forty years, at cost price! At this point the Federal Council intervened, recommending the Canton to try and find a more national solution of the problem. Meanwhile the Government had been approaching some of the big electric concerns in Switzerland to see if they could not collaborate and undertake the construction and operation of the Klingau works. But even this arrangement raises difficulties because of the guarantees already given by the Argovian authorities to the Westphalian company. A second scheme has been brought forward whereby the latter would be allowed to join the united collaboration of certain Swiss concerns, but at a much reduced share in both construction and use of current.

Electrical Treatment of Seeds.

In a recent issue of *Electro Farming* are given some interesting notes on the Carr Bennett process of treating seeds electrically, by means of which, it is claimed, extraordinary results have been obtained. The seeds are first steamed or soaked in either warm or cold water to soften the cuticle or outer skin. The time required for this varies according to the size, nature and condition of the seed, and the exact time at which the seeds should be taken out of soak is largely a matter of experience, though 15 minutes is quite a usual time. As a general rule, soft seeds take less time than hard, big seeds. The important point is that the damping of the seeds should extend to the germs or eyes, but not necessarily into the centre of the core of the substance. The seeds are next drained to remove superfluous moisture, and are spread in a single layer on a sheet of zinc or other rustproof conducting metal, so that each seed is earthed by contact with the plate. Next, high-frequency current is applied. The terminal of the high-frequency machine is connected to that of an evacuated glass cylindrical roller. While the discharge is in progress, this roller glows with a red-violet light. It is rolled to and fro over the layer of seeds for from five to fifteen minutes, and when this treatment is over, it only remains for the treated seeds to be air-dried to restore them to their natural condition. The vitality and germination capacity of the seeds is somehow very considerably improved, and in poor soils, without the aid of any manuring, plants have yielded heavy crops. An experiment on peas was arranged. Three plots were marked off for this purpose; the first was horse manured and planted with ordinary seed; the second was cow manured and planted with ordinary seed; the third was left without manure, but was planted with electrified seed. Three-quarters of the total crop came from this third plot.

Fatalities.

An inquest was held at Church Village, near Pontypridd, Glam., on December 27th, on Oswald Morris and his wife, who received fatal electric shocks whilst erecting a wireless aerial. It was stated that Morris was putting the aerial above the roof when the wire came into contact with a 230-V cable. In returning a verdict of "Accidental death," the jury expressed the opinion that "live" wires near a house should be insulated.

A similar fatality occurred at Langwith on December 29th, when Thomas Frederick Bradbury Martin was erecting a wireless pole in his garden. Fastened to the pole was a wire intended to form a stay to support the pole. The wire touched an electric cable serving Langwith and Shirebrook collieries, and Martin received a shock at 6,000 V. He was conveyed to the Mansfield Hospital and died shortly after admission from burns and shock.

Lecture.

At a meeting of the Paisley Association of Electrical Engineers on December 18th, Mr. A. W. Johnston gave a lecture on "Pulverised Fuel," in which he outlined the difficulties which had to be overcome in the development of the new method of firing.

The Lighting Problem in Factories.

A timely article in the December issue of *Industrial Welfare*—the organ of the Industrial Welfare Society (Incorporated) deals with the subject of adequate illumination in factories and workshops. It is pointed out that bad lighting not only injures eyesight, but also reacts on the spirits and the nervous system, besides increasing the risk of accident. A case is cited of an annual record of over 400 accidents being reduced to 150 by the increase of the lighting allowance from 40 to 100 watts per employé, at a cost very far below the amount of compensation saved. The effect of good lighting on the output of work is also shown to be worth many times the cost incurred. The importance of scientific design as regards reflectors, lamps, and spacing is emphasised, and an ingenious fitting which is said to reflect all the light of a gasfilled lamp whilst hiding the brilliant filament is described.

Illumination of Traffic Points in Edinburgh.

A lighting experiment at traffic points where policemen are on duty is to be carried out by the Edinburgh Corporation. It has been found possible to project beams of light from underground of sufficient intensity to produce a form of flood lighting which brings the constable and his movements into the required prominence. The device incorporates four electric lamps, which are secured underneath a manhole cover, measuring, say, 25 inches square, the lamps being protected by sections of thick glass to withstand ordinary traffic. The type of lamp recommended has a maximum voltage of 12 V, so that, when run off the city mains, resistances would have to be interposed, and it is suggested that the resistances should be so disposed as to produce the effect of a foot-warmer for the constable. The Corporation is to give the system a trial.

Mine Signalling Bells in Parallel.

In a report issued by the Mines Department "On an investigation at the Mines Department Testing Station, Sheffield, of the safety of certified mine signalling bells when connected in parallel," by Capt. C. B. Platt, M.B.E., superintending testing officer, and Mr. R. A. Bailey, Ph.D., investigator (H.M. Stationery Office, price 6d. net) an account is given of further experimental work by which it has been shown that, under certain limiting conditions, certified bells may safely be connected in parallel on a bare-wire circuit. Three methods to diminish the energy of the break-flash at the signal wires to less than that which will cause ignition of the most readily ignitable firedamp-air mixture were investigated, namely, by reducing the battery voltage, by increasing the safety factor of the individual bells, and by limiting the current in the main circuit. The first method is ruled out as very unreliable on account of the differing characteristics obtaining for bells of different makes. The second method is also objected to because, to ensure the safety of a circuit containing several bells in parallel, it is necessary to reduce the resistance of the shunt to a figure comparable with the resistance of the magnet coils themselves. In the third case, the results of the investigation show that, whatever the number of bells connected in parallel (of equal resistances), the added resistance necessary to ensure the safety of the circuit need not exceed one quarter of the resistance of the magnet coils of an individual bell. The only sure way of including the necessary resistance in the main circuit, and of being certain that it will always remain there and function, seems to be to include it as "internal resistance" of the battery. Experiments have shown that a type of battery of sufficiently high internal resistance to ensure the safety of nearly all types of certified bells when used in parallel is the porous-pot Leclanché battery, consisting of cells of three-pint size connected in simple series, provided that not more than one battery of this type is connected in the system. There are one or two types of certified bells which are not safe for use in parallel in indefinite numbers, even with the battery in question, but they require only slight modification to make them so. It should be clearly understood that modifications of the ordinary Leclanché cell, having a relatively low internal resistance, such as the "Carsac" and the "Carporous," as well as so-called dry batteries, are not safe for use with certified bells in parallel when operated from bare-wire signal circuits. The characteristics of certified relays were also examined during the course of the investigation, and it was found that in most instances relays have a safety factor considerably greater than that of certified bells, particularly in those instances where the relay has a high resistance. Nevertheless, it is advised that the same precautions as those recommended for bells should be adopted when relays are connected in parallel in a bare-wire circuit.

Co-ordinating Electricity Supply in Australia.

The Australian Commonwealth Engineering Standards Association has compiled a list of voltages which have been adopted as Australian standards. The eastern and south-eastern coastal area of Australia contains some 90 per cent. of the population of the entire continent, and this area also contains most of the coal and water-power resources. In the course of time there will be a series of generating stations, both steam and water power, extending throughout this area, each one interconnected with those on each side of it. In order that the utmost economy and convenience may result from this arrangement, it has been decided that all such stations shall generate 3-phase alternating current having a frequency of 50 cycles per second, and it has also been decided that wherever practicable the transmission voltage shall be 66,000 V. At present the railways, both in New South Wales and Victoria, are using 25 cycles, a fairly large installation in Queensland has adopted 60 cycles, and the Western Australian Government is using 40 cycles. Fortunately, however, none of these installations will seriously affect the situation, and for industrial purposes 50 cycles is practically the universal standard for the western and south-eastern portions of the Commonwealth.—*Industrial Australian and Mining Standard.*

"A Little Knowledge . . ."

The following consecutive items appeared recently in the "Personal" column of a Kentish paper:—

The relatives of the late ——— wish to thank all kind friends for sympathy and flowers sent.

Accident compensation claims. Advice free and assistance given in genuine cases.—Write ———.

Amateur with very little knowledge of electricity has successfully wired his small house and installed electric lighting set.—He would be pleased to give information to anyone writing to ———, Sevenoaks.

We have, of course, suppressed the identification marks, but otherwise the reproduction is a faithful copy of the original text. We suggest that the notes should be read in the reverse order; then they would aptly serve to point a moral, the trend of which is obvious.

It is bad enough to have amateurs "with very little knowledge" messing about with electric lighting installations, but when they offer to impart their ignorance to others—surely the limit is reached. No doubt the offer is not wholly altruistic; in other words, the advertiser seeks to do the professional contractor out of a job, or jobs. If any doubt has remained in a reader's mind as to the propriety of supporting the registration of contractors—and wiremen—this incident should settle it.

Electricity in Mines.

A report by Mr. Ilsley, electrical engineer of the United States Bureau of Mines, shows that the British regulations covering the installation, inspection, and maintenance of electrical equipment in gassy coalmines provide safer conditions for the mine worker than those in America. Mr. Ilsley declares, however, that in connection with strictly safe equipment in gassy sections there is much yet to be done in both countries. In British coalmines there are no trolley locomotives, whereas statistics recently compiled indicate 11,986 in the United States. Every piece of apparatus and practically every conductor in British mines is earthed by conductor to a plate on the surface; practically no earthing is resorted to in American mines, except to connect the frames of stationary motors to a pipe or rail return within the mine. Alternating current is not used extensively in American mines, but in British mines it prevails, and direct-current circuits are being replaced by alternating-current circuits in a number of mines. The natural conditions in British mines as to grades, faults, thinness of seams, extreme depth of shafts, and the difficulty of properly supporting the over-burden render the installation of electrical equipment much more difficult than in American mines, says the *Manchester Guardian Commercial.*

Institution of Electrical Engineers.

ANNUAL DINNER.—The annual dinner of the Institution will be held on Thursday, February 7th, at the Hotel Cecil, London, at 7 p.m.

Appointments Vacant.

Junior distribution assistant for the Aldershot Gas, Water and District Lighting Co. Station superintendent (£672) for the City of Bristol Electricity Department. Shift engineer for East Grinstead Urban District Council. Resident engineer and chief accountant for Electric Development and Securities Trust, Ltd. (See our advertisement pages to-day.)

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Major J. R. WATSON, O.B.E., who, since the war, has been assistant works manager at Crompton's, Chelmsford, has been appointed accountant with the Crittall Manufacturing Co., Ltd.

Mr. CHAS. HARBON, of Stoke-on-Trent, for eight years chief of the electrical staff of the Lilleshall Coal Distillation Co., Shropshire, has been appointed engineer and manager of the electricity supply undertaking at Budleigh Salterton, Devon.

Mr. R. WILSON EDWARDS has been appointed chief engineer to the New Hucknall Colliery Co., Ltd., Mansfield, Notts., and has consequently resigned his position on the staff of Messrs. D. Selby Bigge & Co., Glasgow, with whom he has been connected for the past 29 years.

Mr. H. C. PARSONS, sales engineer with Messrs. Newtons of Taunton, is leaving after over 20 years' service to take up an appointment with the British Electrical and Allied Manufacturers' Association. He has been presented by the staffs at Taunton and the London office, to which he was recently transferred, with an eight-day clock.

Lady LODGE, wife of Sir Oliver Lodge, F.R.S., has been ill for some time at Normanton House, Lake Salisbury, and toward the end of last week her condition was causing anxiety. Later reports record improvement.

As a token of esteem Mr. H. P. STOKES, transport manager to the Plymouth City Council, has been presented by the management committee of the Tramways Social and Benefit Fund with a case of pipes and a tobacco pouch.

Congratulations to Capt. J. COXON, M.I.E.E., of the Post Office Engineering Department, who was transferred from London to Birmingham in December, 1926, as power engineer for the North Wales District, on his promotion to the position of executive engineer, Technical Section; he will be stationed at Shrewsbury.

Mr. J. R. MORRIS, for many years sole representative in the British Isles for "Columbia" carbon products, is visiting the various factories in the United States of the National Carbon Co. during January and February. The National Carbon Co., Inc., is an important unit of the Union Carbide Corporation, and it specialises in the production of dry-cell batteries, brushes, and all types of carbons.

Mr. T. W. DAVENPORT has retired from the position of superintendent of the Edinburgh and Leith department of the Eastern Telegraph Co.

Mr. W. J. JONES, M.Sc. (Eng.), A.M.I.E.E., who has been on the staff of the E.L.M.A. Lighting Service Bureau for some years, has now been appointed manager of that Bureau in succession to Mr. W. E. Bush, who, as already announced, has taken up other work. Mr. Jones received his training under the late Dr. S. P. Thompson at Finsbury Technical College; subsequently he had experience in the X-ray and Appliances Department, also in the Electric Lamp Department, of Messrs. Siemens Bros. & Co., Ltd. Later he was in charge of the works of A. C. Cossor, Ltd., which post he vacated to join the Lighting Service Bureau staff. He is a member of the Council of the Illuminating Engineering Society.

Obituary.—MR. JOHN LEE.—The death of Mr. John Lee, C.B.E., M.A., &c., occurred suddenly on December 24th while on board the *Laconia* on his return journey from New York, where he had been on a visit connected with the business of the Automatic Telephone Co., of which he became a director when he retired last year from the post of Controller of the Central Telegraph Office. Mr. Lee was born in 1867, and as a boy he entered the Post Office service at Liverpool, subsequently rising from the position of telegraphist to assistant superintendent, assistant traffic manager for telephones (1907), and in 1916 being promoted to the post of Inspector of Telegraph and Telephone Traffic. Three years later, after a brief period as Postmaster at Belfast, he came back to London as controller of the Central Telegraph Office. He had a very full, varied and efficient life in the service. A mere list of the matters in which he was called to figure more or less prominently emphasises the valuable work which an enthusiastic and able man can render during 40 to 45 years. His record comprises the reorganisation of the Indian Railway Telegraph system, membership of the Committee on High Speed Telegraphy, and membership of various delegations to the U.S.A. and to the Continent, including the International Telegraph Conference in Paris over which he presided. He wrote a number of books on telegraph and telephone practice and other subjects, was interested in the principles of scientific management, was profoundly concerned with religious questions and modern movements connected therewith, attended many industrial conferences, was a most acceptable speaker and lecturer and a writer for the Press, while administrative and organising ability and a striking personality also form parts of the outline record of the interests and achievements of one who, according to those who knew him best, was a remarkable man, whose ceaseless industry unfortunately permanently impaired his health, so that he has passed away as a result of a heart attack at the age of 61 years. A Memorial Service was to be held yesterday (Thursday) at Christ Church, Newgate Street.

MR. T. H. MORRIS.—We regret to record the death of Mr. Thomas Harold Morris, of Stretford, Manchester, secretary of Messrs. Ferranti, Ltd. Mr. Morris, who was 45 years of age, was in London on business on Wednesday, December 19th, but after leaving his luggage at his hotel he was not seen again until his body was recovered from the Thames two days later. At the inquest on December 24th, Mr. Morris's brother said that the deceased gentleman suffered from headaches and illness after long journeys. He might have become unwell and after taking his usual remedy, have gone to seek fresh air on the Embankment and somehow fallen into the water. A director of the company testified to the high esteem in which Mr. Morris was held. A verdict of "Found Drowned" was returned, the coroner remarking that there was nothing to suggest either assault or suicide.

DR. DAWSON TURNER.—We regret to record the death of Dr. Dawson Turner, on Christmas Day, at the age of 71; since 1896 he had specialised in X-ray work, at the Edinburgh Royal Infirmary, and like so many other pioneers he paid the penalty, losing several fingers and an eye. Dr. Turner carried out much valuable research work, and developed means for protecting operators and patients from injury by X-rays; he was also an inventor and the author of works on medical electricity and allied subjects.

MR. A. T. HOLLINGSWORTH.—We regret to record the death, in his 82nd year, of Mr. Alexander T. Hollingsworth, who well back in the nineteenth century bought the journal *Engineering* from the late Mr. Zerah Colbourn, and took into partnership Messrs. W. H. Maw and James Dredge, who were conducting the paper. Mr. Hollingsworth had outlived both of these gentlemen, who, along with him, had witnessed and were responsible for, the growth and rise of our esteemed contemporary, which has long occupied a position in the front rank of British technical journalism. Mr. Hollingsworth died on December 31st at his residence at 2, Belsize Grove, Hampstead.

MR. F. R. EDWARDS.—The sudden death is announced, at the age of 50 years, of Mr. Frederick Richard Edwards, electrical engineer, who was in business in St. Albans as the Herts. Electrical Co.

MR. D. FULTON.—The death has taken place at Montevideo, where he was supervising the installation of telephones, of Mr. David Fulton, who took a prominent part in the transfer of the undertaking of the National Telephone Co. to the Government.

Will.—The late Sir HORACE DARWIN, F.R.S., a director of the Cambridge Scientific Instrument Co., Ltd., left £100,919 gross and £91,886 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

W. M. Syndicate, Ltd.—Private company. Registered December 24th. Capital, £2,500 in 1s. shares. Objects: To adopt an agreement with Capt. M. Trouton for the purpose of acquiring his interests relating to royalties under an agreement dated March 5th, 1928, between him and Wireless Music, Ltd., and to carry on the business of manufacturers of and dealers in wireless, loud speakers, and other apparatus, motor horns, gramophones, &c. The subscribers (each with one share) are: F. H. Rover, 31, Alloa Road, Goodmayes, Essex, company secretary; G. Warner, 4, Talbot Road, Alexandra Park, N.22, accountant. Solicitors: Lawrence, Messer & Co., 14, Old Jewry Chambers, E.C.2.

Rogers-Jenkins & Company (Proprietary), Ltd.—Particulars of this company were filed on December 14th pursuant to Section 274 of the Companies (Consolidation) Act. The capital is £100,000 in £1 shares. The company was incorporated in South Africa to acquire the goodwill and other assets of the business of a mechanical, electrical, and contracting engineer carried on by A. Rogers-Jenkins as Rogers-Jenkins & Company, Durban. The registered office is in Natal. The British address is at 21, Chiswell Street, E.C.1, where H. F. Adams is authorised to accept service of process and notices on behalf of the company. The directors are: A. Rogers-Jenkins, 409, Musgrave Road, Durban, merchant; I. H. Pierce, Kubuta, Swaziland, farmer; G. H. Cotton, 64, Cotswold Drive, Johannesburg; G. A. F. Brett, 338, St. Thomas Road, Durban, solicitor; and H. F. Adams, 35, Manor View, London, N.3.

Simpson, Baker & Co., Ltd.—Private company. Registered December 27th. Capital, £20,000 in £1 shares. Objects: To acquire the business of electrical suppliers, factors and agents, carried on by C. M. Simpson and A. C. Baker at 2-5, Nelson Street, Bristol, and at 32, Newman Street, Marylebone, London, as "Simpson, Baker & Co.," also to carry on the business of manufacturers of and dealers in telegraphic, telephonic, and radio apparatus, &c. The subscribers (each with one share) are: C. P. Dawes, East View, Hillcrest Avenue, Edgware, company secretary; V. E. T. Daniel, 183, Lauderdale Mansions, W.9, clerk. Solicitor: C. E. Edwards, 16, St. Andrews Crescent, Cardiff.

Stotts Wire-Covering Machines, Ltd.—Private company. Registered December 24th. Capital, £2,000 in £1 shares. Objects: To adopt an agreement with Lottie Stott and N. Stott, to develop and turn to account the business of an inventor and producer of wire-covering machines carried on by Lottie Stott at Sorrel Bank Works, Pendleton, Manchester, and to carry on the business of manufacturers of machines, mechanical contrivances and apparatus, manufacturers of and dealers in metal, wire and materials for the insulation of wires or other electrical conductors, &c. The first directors are:

Mrs. L. Stott, "Sunnyside," Cavendish Road, Eccles, near Manchester; H. N. Allott, 20, Cromwell Road, Stretford, near Manchester, consulting civil engineer; S. A. N. Deluce, 1, Duffield Road, Irlams-o'-th'-Height, near Manchester, engineer. Registered office: 323, Bolton Road, Irlams-o'-th'-Height, near Manchester.

Fromray Parent Co., Ltd.—Private company. Registered December 22nd. Capital, £120 in 20 "A" and 100 "B" shares of £1 each. Objects:—To acquire from V. C. From the benefit of certain existing inventions and discoveries relating to the use of electricity, &c. The directors are:—C. D. Rowley (chairman), 15, St. James's Place, S.W.1; V. C. From, address not stated. Solicitors: Boyce, Evans & Sheppard, 14, Stratford Place, W.1.

Rotor Electric, Ltd.—Private company. Registered December 22nd. Capital, £500 in £1 shares. Objects:—To carry on the business of manufacturers, importers and exporters of, and dealers in gramophones, phonographs, and other sound-producing or musical instruments and radio, television and electrical apparatus, &c. The directors are:—M. Holzman, 16, Queen's Road, Hendon Central, N.W.4; Madeline B. Holzman, 24, Parkfields, Hendon Central, N.W.4. Registered office: 34, Kingsway, W.C.2.

Dual Motors, Ltd.—Private company. Registered December 19th. Capital, £20,000 in £1 shares. Objects:—To carry on the business of manufacturers, repairers, importers and exporters of or dealers in electrical, clockwork, and other motors, engines, springs and articles for gramophones, &c. The subscribers (each with one share) are:—R. A. Parkin, 18, Dilston Grove, S.E.16, solicitor's clerk; A. W. Pears, 6, Colchester Avenue, Manor Park, E.13, solicitor's clerk. Registered office: 86, New Bond Street, W.

Phos Development, Ltd.—Private company.—Registered December 18th. Capital, £4,050 in 4,000 preferred shares of £1 each and 1,000 deferred shares of 1s. each. Objects: To undertake and engage in the improvement, development, and exploitation of any inventions, patents, and secret processes relating to "Television," and to carry on the business of importers and manufacturers of, agents for and licencees of gramophone records, television, electrical and wireless apparatus, &c. The directors are: Dr. C. Ruzicka, 3, Hope Terrace, Middle Lane, Hornsey, N.8; J. A. Seddon, 12, Woodbury Gardens, Finchley, N.12; A. J. Harvie, 96, Piccadilly, S.W.: A. J. Clark, The Old Friary, Wraysbury, Bucks.; Capt. H. Pearce, 8, Garway Road, W.2; Capt. J. T. Rees, "Fairlawn," Banstead, Surrey. Secretary, S. O. Garrett. Registered office: 68, Victoria Street, S.W.1.

New Era Wireless and Electrical Co., Ltd.—Private company. Registered December 19th. Capital, £500 in £1 shares. Objects: To acquire as from January 1st, 1929, from Gladys E. Green, the business known as the New Era Wireless and Electrical Company, and to carry on the business of manufacturers, buyers, sellers and hirers of electrical and wireless apparatus of every description, gramophones, musical instruments, &c. The first directors are: C. H. Cohen, engineer, and Mrs. G. Green, both of Ingoldsby, Coventry Road, Sheldon, near Birmingham. Registered office: 3, Hobmoor Road, Small Heath, Birmingham.

Official Returns of Electrical Companies.

Carlisle and District Transport Co., Ltd. (formerly City of Carlisle Electric Tramways Co., Ltd.).—Trust deed dated December 18th, 1928, to secure £60,000 prior lien mortgage debenture stock, constituting a specific charge upon the company's tramways, lands and buildings in Carlisle, and upon all shares held by the company in Richard Percival, Ltd., and a first floating charge upon the company's undertaking and property, present and future, including uncalled capital. Trustees: J. Harrison, Lloyd's Bank Buildings, King Street, Manchester; and A. Maconachie, 2, Dr. Johnson's Buildings, Temple, E.C.4.

Alderley and Wilmslow Electric Supply, Ltd.—Satisfaction in full on July 1st, 1928, of first mortgage debentures dated July 19th, 1900, and May 24th, 1911, securing £15,000. (Notice filed December 20th.)

S. G. Leach & Co., Ltd.—Debenture dated December 3rd, 1928, to secure all moneys not exceeding £3,000, charged on the company's undertaking and property, including uncalled capital. Holders: M. W. Woods, Ltd., Denmark Street, Colchester. (The above charge ranks in priority to debentures already registered.)

British Electrical Reproduction Co., Ltd.—Debenture dated November 29th, 1928, to secure all sums due or to become due not exceeding £500, charged on the company's undertaking and property, including uncalled capital. Holder: G. E. Myers, 88, Kingsway, W.C.2.

Radio Company of Great Britain, Ltd.—Capital, £100 in £1 shares. Return dated September 25th, 1928. All shares taken up. £100 paid. Mortgages and charges, nil.

Epoch Radio Manufacturing Co., Ltd.—Debenture dated November 1st, 1928, to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Freda B. Laserson, 88, Woodstock Avenue, Golders Green, N.W.

Hendon Electric Lamp Co., Ltd.—Capital, £1,995 in 1,900 preferred ordinary shares of £1 each and 1,900 deferred founders' shares of 1s. each. Return dated June 26th, 1928. 1,406 preferred ordinary and 1,900 deferred founders' shares taken up. £801 paid, £700 considered as paid. Mortgages and charges, nil.

A. Cunningham & Co. (Manchester), Ltd.—Capital, £4,000 in £1 shares. Return dated September 27th, 1928. 1,057 shares taken up. £586 (£1 on 537 and 2s. on 500) paid, £20 considered as paid. Mortgages and charges, nil.

Western Counties Electrical and Engineering Co., Ltd.—Capital, £6,000 in 3,000 preference and 3,000 ordinary shares of £1 each. Return dated September 27th, 1928. 2,015 preference and 2,026 ordinary shares taken up. £1,211 paid on 611 preference and 600 ordinary shares, £2,830 considered as paid on the remainder. Mortgages and charges, nil.

Delabole Electric Lighting and Supply Co., Ltd.—Satisfaction in full on September 10th, 1928, of mortgage dated September 18th, 1915, securing £200.

Oriental Telephone and Electric Co., Ltd.—Satisfaction to the extent of £6,965 on December 11th, 1928, of debenture stock secured by trust deed dated June 28th, 1905, and supplemental deed of acknowledgement dated June 12th, 1907, securing £200,000.

Rushden and District Electric Supply Co., Ltd.—Issue from September 25th to December 11th, 1928, of £2,500 debentures, parts of a series already registered.

Bayliss, March & Newey, Ltd.—Debenture dated December 14th, 1928, to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital (subject to prior charge dated July 12th, 1927). Holder: J. S. Cooke, 31, Solihull Lane, Hall Green, Warwickshire.

City Notes.

Foundation Co., Ltd.

The annual meeting was held on December 28th. Mr. J. G. B. Stone (chairman), who presided, reviewed the accounts, and said that although the results had not been quite so good, they could be considered satisfactory. The short-term notes fell due at the end of 1929, and when dealing with their repayment the directors proposed to provide additional funds in a more permanent form, and generally readjust the capital. In their general engineering department they had expanded considerably in connection with the erection of overhead lines under the Government "grid" scheme. The new office building which the company was erecting for the Underground Railway Company was nearing completion. While they had retained and probably improved their position as contractors for the erection of super power stations, the delays inevitable from Government control had made the year disappointing, and in respect of general heavy engineering work competition had increased because of the unexpected reduction in demand, but they had specialised in comprehensive works where mechanical and electrical engineering could be combined with civil engineering, not only in respect of electric generating plant, but also in general factory construction, and to-day they believed that they had an organisation almost unique in that respect, which they hoped to utilise to advantage when industrial development became more general.

Adelaide Electric Supply Co., Ltd.

At the recent annual meeting in Adelaide, the chairman (Mr. J. K. Samuel) said that the changing over of the system of supply was proceeding, but the full effects would not be felt until the completion of the work in about two years' time. Delivery of a new 15,000-kW turbo-alternator was expected early in 1929, and a further 10,000-kW set had been ordered for delivery in April; the latter would replace two old 5,000-kW sets. During the past year their sales of electricity for domestic purposes had increased by 23 per cent. The company was keeping a watchful eye upon the development of the use of pulverised coal and liquid fuel for boilers. He concluded by stating that the board proposed to create 250,000 6½ per cent. "C" cumulative preference shares, raising the company's capital to £3,000,000. These would be offered to existing shareholders in Adelaide and London in the proportion of one to eleven. The accounts were passed and the increasing of the capital was sanctioned.

Stock Exchange Notices.

The undermentioned have been ordered to be officially quoted:—

Atlas Light & Power Co., Ltd.—114,789 ordinary shares of £1 each, fully paid, Nos. 2,635,212 to 2,750,000.

Underground Electric Railways Co. of London, Ltd.—21,239 ordinary shares of £1 each, fully paid, Nos. 6,428,722 to 6,449,960.

Manx Electric Railway Co.

The directors report a gross profit of £42,007 for the year ended September 30th (against £40,508 in 1926-27). The net working profit rose from £10,867 to £12,515. To this is added £878 brought forward, making £13,393. After deducting debenture interest, &c., there remains £3,641, which it is proposed to carry forward. The number of passengers carried rose from 549,604 to 593,129.

Commonwealth Power Corporation.

The gross earnings of this corporation and its subsidiaries during the year ended November 30th last were $58,066,062 (against $52,837,351), and the amount available for dividends was $16,015,874. Regular quarterly dividends of 1¼ per cent. on the 6 per cent. preferred stock and 75 c. per share on the common stock have been declared.

International Telephone and Telegraph Corporation.

To finance the purchase of the United River Plate Telephone Co., Ltd., and for other purposes, the Corporation is making an issue of 10-year convertible 4½ per cent. gold debenture bonds. Holders of the bonds will be able to exchange them for common stock at the rate of $200 per share up to July 1st, 1932, or thereafter at a higher rate.

Marconi International Marine Communication Co., Ltd.

The resolution for the alteration of the company's articles of association to ensure that the British control of the company shall be maintained was duly confirmed at an extraordinary general meeting on December 31st.

Crompton-Parkinson, Ltd.

The directors announce their intention of redeeming the whole of the outstanding first mortgage debentures on June 30th at the rate of 105 per cent.

German Companies.

The accounts of the *Siemens and Halske A.G.* for the year ended September 30th, 1928, show net profits of 18,450,000 marks, as compared with 18,851,000 marks in the previous year; the dividend is increased from 12 per cent. to 14 per cent. The net profits were arrived at after writing off 597,000 marks for depreciation (748,000 marks in 1926-27) and applying 4,550,000 marks to legal social welfare purposes (3.57 millions in 1926-27), and 2.79 millions (2.35 millions) to voluntary social welfare objects.

The accounts of the *Siemens-Schuckert Company* show the following appropriations for the year ended September 30th, 1928: Depreciation, 1,690,000 marks (1,430,000 marks in 1926-27); legal social burdens, 8,000,000 marks (6,120,000 marks); and voluntary social welfare purposes, 5,860,000 marks (5,090,000 marks). The net profits are returned at 16,560,000 marks, as compared with 14,780,000 marks in the previous year, and the dividend rises from 9 per cent. to 10 per cent.

French Companies.

The *Compagnie des Exploitations Electriques* has declared a dividend of 20 fr. per share out of net profits of 3,955,000 fr. for 1927-28.

The *Société Financière Electrique* reports net profits of 11,632,000 fr. for 1927-28 and is paying dividends of 40 fr. on the old preference shares, 15.65 fr. on the new preference shares, and 8.55 fr. on the ordinary capital.

The *Société pour l'Equipement Electrique des Véhicules* reports gross profits of 2,011,000 fr. for the year ended in September as compared with 801,000 fr. in the previous year. The dividend is maintained at 30 fr. per share.

The *Société Industrielle des Téléphones* records net profits of 7,480,000 fr. for 1927-28 (against 10,139,000 fr.); the dividend is 24 fr. per share. Authority has been given to make an issue of bonds up to an amount of 30,000,000 fr.

Stocks and Shares.

MONDAY EVENING.

THE year 1928 will stand out in the chronicles of the Stock Exchange as being one that witnessed very unusual activity in stocks and shares of companies connected with industry and commerce. It is generally the case that a year produces, if not a boom, at all events a semblance of one, in some particular market or a particular group in that market. The twelve months that have just closed brought a remarkable amount of animation and an extraordinary list of rises in the stocks and shares of companies connected with industrials. Money has been tolerably easy during the period, the Bank rate not having varied from 4½ per cent. since April, 1927, and this in spite of the fact that money several times in New York, where gambling reached a point akin to madness, rose well into double figures.

Capital and New Issues.

It may at first sight appear anomalous that during a time when national trade was far from flourishing, and its progress has been disappointingly slow, there should have been this excitement in Stock Exchange markets, though it requires no great perception to see how the mere fact of trade being quiet acts as a stimulus to Stock Exchange investment and speculation. If capital is unable to find profitable outlet for its use in the world of commerce, it is bound to seek such channels as those which the Stock Exchange offers for its employment. Hence it happens that speculative activity may, and probably will, synchronise with sluggishness in the chief national arteries of trade. Luxury, entertainment and amusement, new processes in coal and other branches of industry, have proved so popular amongst capitalists that scores of new companies were formed, during 1928, and their shares secured ready response in most cases.

Strength to Strength.

The year has been one in which the principle of amalgamation, working agreements, and absorption, made giant strides. Some of the older combinations of pre-war days look puny compared with the schemes that are now accepted as being almost commonplace. It is frequently remarked that whereas before the war the ordinary man thought in hundreds, he now thinks in thousands or tens of thousands, this applying to financial operations more particularly. Nevertheless, apart from the check imposed upon confidence by a sharp fall in a specialised group of shares, brought about by the death of Mr. Alfred Loewenstein, the year has suffered comparatively few reactions of any moment. Stock Exchange prices have gone from strength to strength, and the end of 1928 finds extraordinary rises in a number of securities which nobody suspected beforehand enjoyed that speculative flavour which would commend them to the operator in stocks and shares, or would provide their holders with more than a steady income on the money. The unexpected has happened, and, to take one example, the Eastern Telegraph group has appreciated in value to such an extent that people who held the shares this time last year, and who continue to retain them, are very much better off than they were on last New Year's Eve.

Cable Stocks and Shares.

In presenting our usual tables of price comparisons for the twelve months, the Eastern Cable group deserves first consideration, by reason of the increment in value which has occurred in the quotations for the stock and shares. Whereas Eastern ordinary lost 32½ points in the year 1927, this has not only been recovered, but the present price is no less than 127 points higher than it was twelve months ago. Eastern Extensions shed over £3 in 1927: in 1928 the price rose from 15 to 27½. We set out the exact comparisons in the following table:—

CABLE STOCKS AND MARCONIS.

Stock or share.	December, 1926.	1927.	Now.	Rise.
Anglo-American pref. ...	101	93½	103½	10
Eastern Extension	17½	15	26½	11½
Eastern Telegraph	177½	145	267½	122½
Globe ordinary	18½	14½	25½	10½
Great Northern	27	38½	34½*	—
Indo-European	47½	40	47½	7½
Marconi	13/9	37/6	78/9	41/3
Western Telegraph	17½	14	26½	12½

* Ex bonus.

It is hardly necessary, except for the sake of future reference, to do more than mention that this advance in cable stocks has been due to the Government's decision to enter into partnership with the cable and wireless companies. A Bill has been promoted in Parliament, and is within easy reach of receiving the Royal Assent, which, under the title of the Imperial Telegraphs Bill, will consolidate the interests of the private companies and of the Government beam system.

The Wireless Whirligig.

The effect upon Marconis has been just as dramatic as in the case of the cable issues. From 37s. 6d., Marconis rose almost without a break to 85s., and, although reaction occurred from the top, the price at 78s. 9d. has more than doubled within the twelve months. Canadian Marconis have undergone yet more extraordinary fluctuations, the price at this time last year being 9s. 9d., and rising, in November, to £6 a share for about half-an-hour one night in Throgmorton Street dealings, when the pressure to buy from America became particularly acute. The boom subsided more quickly than it arose, and the shares went back to 30s. within a few weeks. Marconi Marines have made similar progress, and the current price of 3⅞ compares with 30s. last New Year's Eve. The wireless market, as a whole, has attracted its full share of popular speculative interest, and American buying was very persistent on various occasions.

London Electricity Supply.

The market for electricity supply shares shows moderate rises in the values of the principal London companies, whose tenure under present conditions runs out in 1931 or thereabouts, to be replaced by a fresh set of conditions under the London Electricity Supply Acts. This has the effect of turning the shares into what the Stock Exchange technically calls money stocks. They are perfectly sound investments, but the prospect of appreciation in price holds out so little of promise, having regard to the lowering of the dividends in the fairly near future, that the shares are left to the investor who is content with a useful return upon money invested in sound

industrial undertakings. The County of London stands in a different position from the others, hence the very considerable rise that has occurred in the price of the ordinary shares. This has been assisted by the advance in Bournemouth and Poole, and in shares of other subsidiary undertakings. Metropolitans have also gone ahead, there being a persistent rumour at one time to the effect that Americans were endeavouring to buy for control purposes. Apart from these two exceptions, it will be noticed that the group, while showing satisfactory increase in capital appreciation, presents no striking points of interest.

ELECTRICITY SUPPLY SHARES.

December.

Ordinary.	1926.	1927.	Now.	Rise.
Brompton	1¼	24/6	27/-	2/6
Charing Cross	25/-	26/-	26/6	6d.
Chelsea	25/-	25/6	27/-	1/6
City of London	42/6	30/-	30/9	9d.
County	26/-	28/6	44/6	16/-
Kensington	24/-	25/6	26/6	1/-
London	24/-	25/-	26/-	1/-
Metropolitan	39/6	30/-	46/3	16/3
St. James'	24/-	26/-	27/6	1/6
South London	24/6	25/6	27/6	2/-
Westminster	24/6	25/6	27/-	1/6

Tube Railways.

It has been a bad year for railways as a whole, although a good deal of money has been spent on electrical plant, &c., by the steam companies. The Tube Railways have come out well, Underground Electric Railways of London advancing substantially, both as regards the shares and the income stock, in consequence of the increased dividend paid on the former, and the option which the income stock now has of conversion into the "A" shares at £1 1s. each. The newly-introduced sport of greyhound racing has not made much further progress, and Metropolitan Consolidated, which was expected to benefit by the new amusement, has slipped back some five points, although, on the other hand, Districts have risen 14½. This table shows the net movements of the year :—

RAILWAY STOCKS AND SHARES.

December,

Stock or share.	1926.	1927.	Now.	Rise.
Central London ord. ...	69	71	73	2
Metropolitan	63	70	65	–5
District	53½	66	80½	14½
Underground "A" ...	12/-	19/6	26/6	7/-
Underground Income ...	103	105	126	21

Tramways.

In regard to the tramway shares, a fairly general advance has taken place by reason of the steps taken towards the unification of traffic control in London. London United Tramways 4 per cent. debenture at 61 is 7½ up on the year, and compares with 42½ at the end of 1926. London and Suburban Traction preference at 13s. have gained 5s. Mexico Tramway fives at 79 are 7 points higher, and Mexican issues as a whole show improvement. Brazilian Tractions have been moving in spectacular fashion. The shares were subdivided early in the year, and the present price of 77½ is equal to 310, as against 224 a year ago. Looking back a little further, it may be recalled that Brazilian Tractions stood at 80 in December, 1925. British Electric Traction deferred stock at 615 is 115 points higher on the year.

The Manufacturing Group.

Manufacturing companies' shares have been in fairly steady request throughout the greater part of the year. It is said that in some cases Americans have been endeavouring to acquire control through purchase of shares, but official statements have been made to satisfy the desire that the companies should remain British. The year has made it evident that the principle of co-operation adopted by some of the leading companies is working satisfactorily. Here are half-a-dozen companies for the purpose of comparing twelve months' prices :—

December,

Share.	1926.	1927.	Now.	Rise or fall.
Babcock	2⅝	3⅛	3½	+ ⅜
British Aluminium ...	48/-	45/6	2¼	– 6d.
Callender's	3 7/16	3 15/16	4 1/16	+ ⅛
General Electric ...	31/-	33/6	43/9	+10/9
Henley's	4⅜	5⅛	5¼	+ ⅛
India-Rubber	21/3	13/9	11/3	– 2/6

It may be noticed, by those who are curious in such matters, that in these lists of comparative prices there are 26 rises and only three falls. The quotations were taken as being representative, and with no intention to emphasise advances against declines. The proportion of the former is as striking as it is typical of the general trend of movements during 1928 in most industrial stocks and shares. It is with very cordial wishes that the same pleasant process may be continued in a Happy New Year to readers of these paragraphs that this last line is written in the closing hours of 1928.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend. 1926.	1927.	Price Dec. 31, 1928.	Rise or fall.	Yield. p.c.
	£					
Bournemouth and Poole	1	14†	15	8⅜	+⅛	... ...
Brompton Ordinary	1	8⅜	8½	27/-	—	5 8 9
Charing Cross Ordinary	1	8½	8½	26/6	—	5 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅝	8⅝	27/-	—	5 3 8
City of London	1	10	10	30/9	—	4 16 0
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	38/6	—	4 3 0
County of London	1	7½	7½	44/6	+6d.	3 7 9
do. do. 6% Pref.	1	6	6	23/6	—	5 4 4
Edmundsons' 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	11	50/9	—	4 6 8
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	26/-	—	5 7 8
Metropolitan	1	8	9	46/3	+⅛	3 18 0
do 4½% Pref.	1	4½	4½	17/6xd.	+4½d.	5 2 10
Midland Counties	1	6	6½	30/-	—	4 6 8
Mid. Elec. Power	1	—	15	2	—	... ..
Newcastle-on-Tyne Ordinary ...	1	5	6	26/3	—	4 11 5
do. 7% Pref.	1	7	7	28/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	10¾xd.	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	5	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	31/6	—	5 1
South London	1	8½	8½	27/6	—	5 2 8
Urban Ordinary	1	7	7	26/9	—	... ...
Westminster Ordinary	1	8½	8½	27/-	—	5 3 8
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	24/-	—	6 5 0
Yorkshire Elec.	1	8	8	35/-	—	4 11 5

†4% of which was tax free.

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	78	—	5 9 7
Metropolitan	,,	3	3	65	+½	4 12 4
do. District	,,	3½	4	80½	—	4 19 5
Underground Electric	£1	1½	5	26/6	—	3 15 7
do. do. Income ...	Bonds	6	6	126	—	4 15 3

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103½	+1	5 16 0
do. Def.	,,	1½	1½	25½	+⅜	5 18 10
Automatic Telephone	1	10	10	2⅛	—	4 16 10
Eastern Extension	10	10	10	26½	+⅝	*3 15 0
Eastern Tel. Ord.	Stock	10	10	267½	+5½	*3 15 0
Globe Tel. and T. Ord.	10	10	10	25½	+¼	*3 18 6
do. do. Pref.	10	6	6	11xd.	—	5 9 1
Great Northern Tel.	10	20	20	34½	+4½	... ...
Indo-European	25	10	10	47½	—	*3 5 8
Marconi	10/-	5	*10	3⅛	+⅛	... ...
Marconi-Marine	1	8½	12½	9⅝	+⅜	3 9 1
Oriental Telephone Ord.	1	12	12	9½	—	*3 18 0
United R. Plate Tel.	5	8	8	11½	—	*3 8 1
Western Telegraph	10	10	10	26½	+⅜	3 15 0

*Interim.

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8⅝	—	7 11 9
do. do. 2nd. Pref. ...	5	6	6	5⅞	—	8 14 6
do. do. 5% Deb. ...	Stock	5	5	77	—	6 9 10
British Electric Traction Def. Ord.	,,	—	—	615	—	... ...
do. do. Pref. Ord.	,,	8	8	124	—	6 9 1
Brazil Traction	100	6	7	77½	—	2 5 2
Brit. Colombia Elec. Rly. Pcs. ...	Stock	5	5	96½	—	5 2 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	13/-	+1/-	... .
London United Tram Deb. ...	Stock	4	4	61	+1	6 11 4
Mexico Trams. 5% Bonds	—	5	5	79	—	6 6 7
Mexican Light Common	100	Nil	Nil	77½	—	... ..
do. 7% Pref.	100	Nil	7	76½	—	9 3 0
do. 1st Bonds	—	5	5	77	—	6 10 9
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ..

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	18	15	3½	+⅛	*4 5 9
British Aluminium Ord.	1	10	10	2¼	+1/16	*4 9 0
British Elec. Transformer Pref....	1	7	7	15/-	– 8/-	9 6 8
British Insulated Ord.	1	15	15	4⅛	+⅛	3 12 10
Brush Ord.	1	10	10	28/9	—	6 19 2
Callenders	1	15	15	4 1/16	+1/16	3 14 0
do 6½% Pref.	1	6½	6½	1⅞	—	5 9 5
Crompton Parkinson Ord.... ...	5/-	—	—	19/6	–6d.	... ...
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan	4/-	10	10	12/6	—	3 4 0
do. 5% Deb.	Stock	5	5	86½xd.	—	5 15 7
Electric Construction	1	7½	7½	26/9	—	5 12 1
Enfield Cable Ord.	1	20	20	£4	+⅛	3 16 0
English Electric	1	Nil	Nil	7/6	—	... ..
do. do. Pref	1	8	Nil	10/-	—	... ..
Gen. Elec. Pref.	1	6½	6½	23/6xd.	—	5 10 8
do. Ord.	1	7½	10	43 9	—	4 11 4
Henley	1	25	25	£3	+⅛	4 6 10
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	11/3	—	... ..
Johnson & Phillips	1	12½	10	36/3	—	5 10 8
Met.-Vickers Ord.	1	8	8	80/-	—	... ...
do. Pref.	2	8	8	2¼	—	5 16 5
Siemens Ord.	1	7½	7½	26/3	—	5 14 2
Telegraph Construction	12	10	10	24½	—	*4 18 6

*Dividends paid free of Income Tax.

Electrical Manufacturing in Canada.

Production in 1926 and 1927.

THE production of electrical apparatus and supplies in Canada was valued at $78,558,730 in 1927, according to a bulletin recently issued by the Dominion Bureau of Statistics, Ottawa. This figure was 13 per cent. over the value of $69,767,308 for the previous year, 30 per cent. greater than in 1925, and 39 per cent. in excess of the output reported for 1924.

Reports were received from 130 firms in this line of production, with fixed and working capital of $80,475,999, giving employment to 16,813 people. Salaries and wages totalled $20,613,592. By manufacturing processes the sum of $45,823,855 was added to the value of purchased materials, which cost $32,734,875. The following table gives particulars of the production during 1926 and 1927 :—

Product.	Selling value. 1926. $	1927. $	Inc. or dec. $
Batteries—			
Storage	4,352,433	4,280,896	− 71,537
Dry cell	3,291,500	3,315,692	+ 24,192
Parts and supplies	123,493	125,423	+ 1,930
Conduit and moulding, interior, and fittings	1,047,846	1,249,636	+ 201,790
Cooking and heating apparatus—			
Flatirons	314,690	363,419	+ 48,729
Hotplates and grills	126,230	277,904	+ 151,674
Percolators	—	12,423	+ 12,423
Stoves and ranges	493,287	573,370	+ 80,083
Toasters	—	81,517	+ 81,517
Water and air heaters	300,200	419,012	+ 118,812
Unspecified	241,893	57,923	− 183,970
Fans	31,525	43,886	+ 12,361
Fuses and fuse wire	287,284	269,801	− 17,483
Generators, a.c. and d.c.	3,222,339	2,183,809	−1,038,530
Ignition apparatus	703,146	757,183	+ 54,037
Lamps, incandescent	3,979,841	4,561,752	+ 581,911
Bulbs, bases and other parts for incandescent lamps	82,944	58,679	− 24,265
Lighting fixtures	1,312,029	1,450,584	+ 138,455
Lightning arrestors	180,112	161,712	− 18,400
Line material, of all kinds	741,163	146,100	− 595,063
Motors—a.c.	4,235,042	4,500,183	+ 265,141
Parts and supplies	160,630	202,912	+ 42,282
D.c.	717,194	685,996	− 31,198
Parts and supplies	113,677	150,206	+ 36,529
Meters, watt-hour, ammeters, voltmeters, &c., service type, including accessories	970,446	1,185,433	+ 214,987
Panel boards and cabinets	384,391	482,969	+ 98,578
Pneumatic tools and parts	1,930,348	1,898,426	− 31,922
Radio apparatus and supplies (excluding batteries)	3,899,517	6,081,067	+2,181,550
Rectifiers for storage battery charging	127,182	184,481	+ 57,299
Refrigerators, electric	85,985	227,103	+ 141,118
Sockets, rosettes, attaching plugs and cutouts	880,036	945,234	+ 65,198
Switchboards, light and power	1,729,506	3,285,927	+1,556,421
Switches, of all kinds	1,204,247	1,961,397	+ 757,150
Telephone materials (excluding line material)	7,508,589	7,925,977	+ 417,388
Transformers—			
Power and service types, 50 kW and over	3,628,794	3,457,016	− 171,778
Power and service types, under 50 kW	1,023,768	2,697,136	+1,673,368
All other types	154,558	324,313	+ 169,755
Vacuum cleaners	1,345,427	1,970,714	+ 625,287
Wires and cables	13,791,282	14,091,076	+ 299,794
Wiring material, n.e.s.	269,087	369,984	+ 100,897
Apparatus or supplies, n.e.s	2,318,013	1,934,833	− 383,180
Repair parts, n.e.s., and repairs	770,407	961,199	+ 190,792
Products of 1 or 2 firms*	1,687,227	2,644,427	+ 957,200
Total	$69,767,308	$78,558,730	+$8,791,422

* Production figures are for the electrical supplies industry only and do not necessarily represent the total output in Canada of the commodities listed; there may be also a small production in other industrial groups.

The Import Trade of Siam.

A Comparison of Two Years' Figures.

THE following figures, showing the imports of electrical and allied goods into Siam during the year ended March, 1928, are taken from the recently-issued official trade statistics; the figures for the year ended March, 1927, are included for the purposes of comparison, and notes of any increases or decreases are given. Imports stated to be from Singapore and Hong-Kong are for the most part the products of other countries shipped *via* these two ports :—

	1926-27. Baht. (Thous.)	1927-28. Baht. (Thous.)	Inc. or dec. Baht. (Thous.)
Electrical goods and apparatus—			
Total	1,743	2,391	+648
From United Kingdom	315	296	− 19
,, Germany	200	669	+469
,, United States	139	234	+ 95
,, Singapore	27	97	+ 70
,, Sweden	5	2	− 3
,, Italy	10	12	+ 2
,, Holland	33	25	− 8
,, France	57	21	− 36
,, Japan	218	167	− 51
Lamps—			
Total	693	896	+203
From Singapore	62	94	+ 32
,, United Kingdom	29	37	+ 8
,, United States	7	2	− 5
,, Japan	104	127	+ 23
,, Germany	358	470	+112
,, Sweden	49	78	+ 29
Scientific instruments and apparatus—			
Total	289	300	+ 11
From United Kingdom	47	76	+ 29
,, Germany	90	57	− 33
,, France	13	10	− 3
,, Japan	65	73	+ 8
,, United States	23	45	+ 22
,, Singapore	29	27	− 2
Prime movers, other than locomotives, marine, military, and agricultural machinery—			
Total	909	848	− 61
From United Kingdom	328	336	+ 8
,, United States	196	305	+109
,, Germany	199	178	− 21
,, Denmark	10	10	—
,, Sweden	166	6	−160
Machinery, unenumerated, including detached parts, and not including agricultural, textile, or sewing machines—			
Total	1,528	1,896	+368
From United Kingdom	453	681	+228
,, Japan	12	3	− 9
,, United States	204	198	− 6
,, France	31	36	+ 5
,, Denmark	28	130	+102
,, Germany	265	313	+ 48
Railway material—			
Total	370	159	−211
From United Kingdom	30	12	− 18
,, Belgium	169	102	− 67
,, France	33	5	− 28
Cars or trucks for railways or tramways—			
Total	1,205	536	−669
From United Kingdom	495	230	−265
,, United States	61	53	− 8
,, Belgium	324	190	−134
Rubber manufactures, other than tires—			
Total	1,076	1,176	+100
From Singapore	643	685	+ 42
,, United Kingdom	99	107	+ 8
,, United States	27	30	+ 3
,, Japan	9	19	+ 10
,, Germany	35	79	+ 44

NOTE.—Tical (or Baht)=1s. 10½d.

Large Induction Motors.

Some constructional features of heavy-duty equipment produced by the British Thomson-Houston Co., Ltd.

ONE of the most arduous duties for which electric motors can be used is the operation of mine winders or hoists, and, in particular, reference may be made to the electric winding equipments installed at the gold mines of the Rand in South Africa. The mines work day and night for seven days a week, and as every trip of the winder involves the reversal of the direction of rotation of the motor at least twice, the necessity for rugged and reliable design is obvious. In many of the mines the workings are now being carried to such great depths that the winding has to be done in stages, and at the Village Deep Mine there is a 1,100-2,300-h.p. geared a.c. winder installed no less than 6,300 feet below ground, this being, it is claimed, the largest hoist at its depth in the world. At the Crown Mines there is in operation a geared a.c. winder, the motor for which is rated at 2,160-4,010 h.p.; this is claimed to be the largest of its type in the world, and duplicate equipment is being manufactured by the British Thomson-Houston Co., Ltd. This company has manufactured a very large number of electric winding equipments for use on the Rand, and it should be noted that owing to the heavy duties imposed on them, and to the very serious consequences of any delay in winding ore due to shut-downs for repairs or overhaul, the equipments must be designed on generous lines. Among other features of construction mention may be made of a special form of dovetail key which has been evolved by the B.T.H. Co. for securing the rotor and stator laminations to the spider and stator frames respectively. This key is of double dovetail section and divided longitudinally so as to give each half a wedge shape. The amount of taper on the two halves of the key is designed so that when driven in the dovetails are forced tightly against the punchings and spider, thereby eliminating all possibility of tangential or radial movement.

Fig. 1 shows a rotor core being assembled. The keys are laid in the dovetail slots machined in the spider, and the two halves of each key are slightly slacked back. The segmental core is then built up, drifts being temporarily placed in some slots to ensure correct alignment; it will be observed that each segmental punching is held to the spider by two double dovetail keys. As the building-up progresses the core is tightly clamped until, finally, with the end flanges in place, it is pulled up tight by clamping bolts arranged outside the core, but close to its inside periphery. The dovetail keys are then removed and broaches shaped to the dovetails are driven through, after which the keys are replaced and driven tightly together.

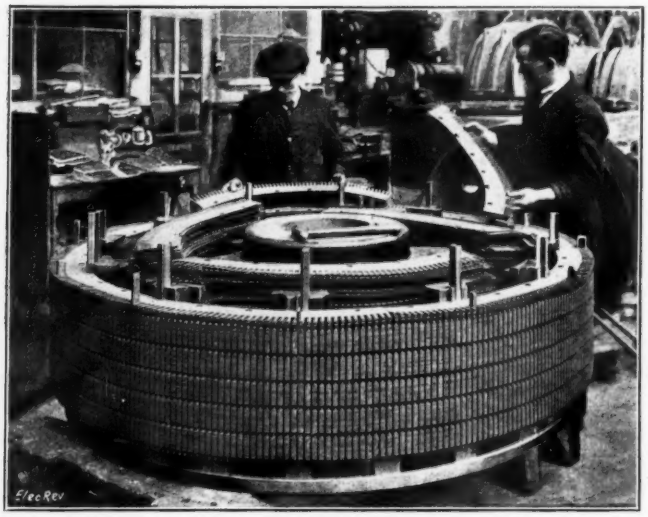


Fig. 1.—Rotor Core Assembly, showing Dovetail Keys.

Fig. 2.—Complete Rotor for Rand Electric Winding Equipment.

The length of each half of the key is adjusted so that the thick end projects slightly beyond the thin end within holes provided in the end flanges. Plugs screwed with fine threads are inserted in the holes in the end flanges and bear against the large ends of the keys. The plugs are provided with square shanks and lock nuts, so that should it become necessary at any time they could be screwed further into the flanges, thus tightening up the keys. In addition to the double dovetail keys in the rotor core, pins are tightly driven through holes in both the end flanges and core. A complete rotor with this type of screwed plug is illustrated in fig. 2, and a close-up view of a portion of a rotor with the screw plugs removed is given in fig. 3.

The above construction is adopted as standard by the B.T.H. Co. for the rotors of all induction motors having cores built up of segmental punchings. In some cases the design is simplified by the omission of the screwed plugs; the keys, after being driven into position very tightly, are cut off flush and the ends welded, cover plates being fitted over the holes in the end flanges so as to bear against the ends of the keys. Fig. 4 shows a rotor of this type with the cover plates over the holes in the rotor flanges removed. Motors embodying this form of construction are in operation on various duties of the most arduous nature, such as driving rolling mills, mine winding equipments, cement-mill plant, and so on.

Fig. 3.—Part of Rotor, showing Key Ends and Provision for Screwed Plugs.

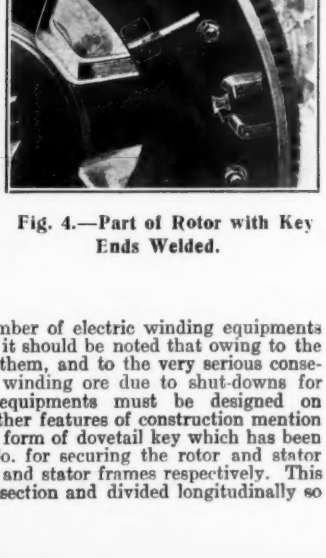


Fig. 4.—Part of Rotor with Key Ends Welded.

Industrial Transport Association.

Mr. P. J. Hannon, M.P., president of the newly formed Industrial Transport Association, an organisation of transport administrators and managers of industrial undertakings, presided on December 4th at the first annual luncheon in London, and stated that in preparation for the Royal Commission on Transport the Federation of British Industries was preparing a memorandum on public life as affected by transport, and at least one expert witness would be received on behalf of the Industrial Transport Association. Mr. J. A. Freeman is chairman of the Manchester branch.

Hire and Hire-Purchase Schemes.

The Third E.D.A. Conference of the 1928-29 Session.

AT the third E.D.A. Salesmanship Conference on December 21st, at the Royal Society of Arts, Mr. J. E. Tapper (Beckenham) read a paper upon the subject of hire and hire-purchase schemes.

Though recognising the advantages of simple hire schemes, as distinct from hire-purchase, the speaker pointed out that an advantage of hire-purchase to the supplier was that he constantly received a return of his capital, so that a smaller sum was required to finance the business. In addition, he was relieved in most cases of the business of maintenance and liability for accident and breakdown, and the customer became interested in the retention of the article, so that it was unlikely to be thrown back on the hands of the supplier. On the other hand, a consumer who hired apparatus had no inducement to keep it beyond the term of the agreement, probably one year, if some better apparatus was placed on the market, or if he was influenced by some other factor. When apparatus was simply hired the supply authority assumed liability for the whole period of the contract, the liability covering maintenance and third-party accidents due to imperfect design or failure of insulation. This emphasised the necessity for ensuring that only really safe apparatus should be hired, though maintenance could be covered, of course, by fixing suitable hire charges, and accidents could be insured against. With regard to the question of safety, Mr. Tapper emphasised the importance of earthing, and suggested that this matter should receive the attention of the Electrical Apparatus Committee of the I.M.E.A. He appreciated that with much apparatus, such as water heaters and cookers, business could be secured only by hiring schemes, but in other cases, as, for instance, irons and other less expensive apparatus, it was better to sell for cash, or by hire-purchase. In Beckenham 3,200 irons had been installed among 6,200 consumers without the necessity for hire; assuming an average use of three hours per week, they consumed a quarter of a million kWh a year.

Dealing with the necessity for hire-purchase schemes, the speaker said that a man who purchased a house more often than not left the question of electrical fittings to the last and then found that he could hardly afford even those of the plainest possible type. In such cases, and they were legion, the only way to secure the business was by assistance from the supply authority.

Owing to the danger that, if no deposit, or only a small deposit, was asked for, the goods might be returned considerably the worse for wear after three or four months, when an insignificant amount had been paid on them, Mr. Tapper said it was not his practice to enter into a hire-purchase agreement, but to deal with the transaction as a definite sale, allowing the consumer to pay by instalments over an agreed period. Under such a "deferred payment" system the authority could exercise discretion as to the acceptance of the return of goods, and it could refuse the return of badly used apparatus and sue the purchaser for payment in full.

Dealing with the progress made in Beckenham, he said that whereas in 1919 the sales turnover was about £2,000, for the financial year ended March, 1928, it was nearly £13,000, an average of £2 4s. 6d. per consumer, or 6s. 10d. per head of the population. Hire-purchase was responsible for £3,717 of this, or practically 30 per cent. Generally, a deposit of 20 per cent. was asked for, with interest on the outstanding balance at 5 per cent. over one or two years, though the Beckenham Council did not tie itself rigidly in the matter of deposit. Hiring had so far been confined to cookers, and 491 of these had been hired since late in 1925, when the business was commenced. Wiring had been carried out on the hire system for many years, but quite a third of the installations had been sold to the consumers. "Free," or rental, wiring was provided throughout in housing schemes and in small properties up to four lamp points. Various methods of charging were in vogue, but that which was found most advantageous was a fixed charge, based upon the ratable value of the premises, plus wiring and cooker rent, energy being metered and charged at 1d. per kWh. A weekly collection was made in connection with the Council's housing schemes, the amount charged being estimated to cover the fixed charge, cooker rent and energy used. At the end of the quarter the meter was read and the balance drawn or refunded as each separate case required. The wiring was carried out by the Council's staff in grip-joint tubing complete with pendants and lamps at an average cost of £7 for eight points. The wiring and installation of the cooker, including a kettle plug point, cost £3 10s. The weekly charges for a particular class of house were: fixed charge, 1s. 5d.; cooker rent, 9d.; and electricity (23 kWh at 1d.), 1s. 11d.; making a total of 4s. 1d. In practice the average weekly charge for energy consumed for all purposes was 2s. 4d., making a total of 4s. 6d. inclusive, so that at the end of the quarter an additional amount equal to 5d. per week had to be collected. The increase was due to the installation of irons and small fires by many consumers. Some 600 consumers were supplied on a "limited" system applicable to lighting only. Four points were installed at a cost of £3 18s. complete with pendants and lamps, the weekly charge varying with the wattage. The average consumption in those houses was 150 kWh per annum, and the average price 4d. per kWh, as compared with the present lighting flat rate of 5d. A similar class of house supplied by meter would demand 100 kWh, so that the limited system resulted in an increased consumption of 50 per cent., although, as the maximum demand was limited, the cost per kWh was less. If a cooker or other apparatus was installed, a meter replaced the limiter; a fixed charge of 1s. per week was made, which covered hire and standing charges, electricity for all purposes being metered through a slot meter at 1d. per kWh.

It had been found that the evening peak load had been affected to a comparatively small extent by superimposing the cooking load upon it. With regard to heating, however, with the introduction of bulk supplies the position was not so clear. A cold snap might occasion a very heavy charge by the bulk supply authority, due to a sudden demand by radiators, without an adequate return from the consumer. Authorities owning capital stations were prepared to accept this load in their own districts. Therefore, Mr. Tapper considered that some method should be devised which would enable that advantage to be passed on to those undertakings accepting a supply from the "grid." A spasmodic heating peak of this nature should be charged for at a lower rate.

Discussion.

Opening the discussion on the paper, the CHAIRMAN (Mr. A. C. Cramb, Croydon), after mentioning that in his experience consumers did not take care of hired apparatus, discussed the possibilities of distributors having to bear a heavy standing charge as the result of a sudden heavy load under the "grid" system, although it might be that that heavy load had been carried for only one night. It seemed to him that under such circumstances it would be cheaper to generate than to buy from the "grid."

Mr. WATT (Woolwich) asked what steps were being taken to standardise cooking apparatus.

Mr. BRYANT (Hackney) criticised the present methods of charging for the hire of cookers, by which the hire rates were cut to a low figure, the supply authority hoping to recoup itself by the surplus revenue resulting from the sale of energy. In a fairly representative case, he said, a standard size cooker would rent at 10s. per quarter and energy would be sold at 1d. per kWh; after allowance was made for overhead charges and maintenance, the price actually received for energy was about 0.6 per kWh. It would be better to charge that price for energy, and increase the rental to, say, £1 per quarter. Although that might hold up the cooker business to some extent, he believed it would go forward again more quickly than before when the consumers appreciated the benefits of the lower price of energy. Under the present system the supply authority lost if the consumers did not use the amount of energy anticipated, and the consumers paid through the nose if they consumed more.

Mr. J. LEADBEATER (Hampstead) said he had found it an advantage to introduce a free maintenance scheme, even for cookers on hire-purchase, for a period of, say, three years. With regard to hire, he said that many engineers in fixing the charge debited the revenue from the consumer first with the cost of maintenance and interest charges, and took what was left for energy, but he regarded it as more correct to debit the consumer with the cost of the energy first and see what was left over for maintenance and interest.

Mr. F. SELLEY (St. Marylebone) emphasised the necessity for an attractive tariff as a first essential to successful hire and hire-purchase schemes. Mr. Tapper had suggested a charge based on ratable value, but he (Mr. Selley) would like to add to that a two-rate tariff, to encourage people to use electricity for water heating during the night. He emphasised the necessity for giving service, and for having a man available at all times to deal with cooker failures.

Mr. BUCKELL (G.E.C.), who also emphasised the importance of maintenance service, expressed the fear that some engineers would not push the sale of electrical apparatus in view of the risk of increased standing charges resulting from high peak loads under the "grid" system, and pointed out that such an attitude would be disastrous at a time when electricity for all purposes was coming into its own.

Mr. W. RITCHIE (Hendon), referring to the author's suggestion that the supply authority had to take responsibility for third party risk in respect of hired apparatus, said that surely the authority could safeguard itself by the terms of the agreements. With regard to hire-purchase apparatus, he suggested that the initial payment on it should on no account be less than the amount of the salesman's commission, and the period of repayment should be within a year, if possible, that being the guarantee period.

Mr. PATMORE asked if users of hired apparatus in Beckenham could buy it at any time if they wished.

Mr. GAIN (Leyton), who said that contractors who had been employed to carry out wiring installations in his district in connection with an assisted wiring scheme had not done any-

thing to push the sale of electrical apparatus in the houses which they had wired, emphasised the importance of outside representatives being employed by the supply authorities.

Lieut.-Col. W. A. VIGNOLES (director and secretary, E.D.A.) emphasised the immense possibilities of hire and hire-purchase, and pointed out that in Beckenham the marked increase in the number of consumers connected and the amount of energy sold had coincided exactly with the adoption of hire-purchase. He also pointed out that, in view of the decreasing costs of maintenance, there should be a tendency to reduce maintenance charges rather than to keep them up to the charges made earlier, when maintenance costs were higher.

The CHAIRMAN said that supply authorities which did not employ outside staffs should hand over the business of electricity supply to someone else. Emphasising the value of proper service, particularly with regard to cookers, he said he had a man on duty on Sunday mornings ready to go at a moment's notice to any consumer whose cooker had failed.

Mr. TAPPER, replying to the discussion, said he was of opinion that the point had not yet been reached at which cookers could be standardised; the real trouble was with the hot plates, and he believed that if an improved hot plate were introduced, he would be able to charge 10s. per quarter profitably for the hire of cookers without expecting the revenue from the energy sold to bear part of the cost. The only way to carry on the cooking business properly was to maintain the apparatus throughout; that was why he did not consider it advisable to sell cookers by hire-purchase. He saw no reason for hiring irons or radiators, in view of their low price. Apparatus which had been hired originally had been bought subsequently by many of his consumers. The Beckenham Council employed canvassers and had established showrooms.

A Large Lighting Installation.

Some Descriptive Notes on the Electrification of Lancing College.

AMONG the public buildings which are being electrified in ever-increasing numbers, it is interesting to note the large proportion of schools—schools of all types, from our oldest and biggest public institutions to the elementary establishments of the various municipal and county councils.

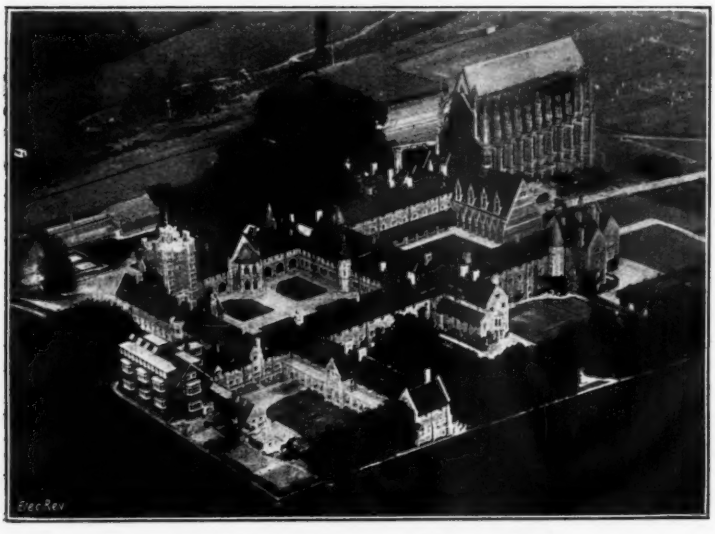


Fig. 1.—Aerial View of Lancing College.

One of the latest to come into line in this respect is Lancing College, which was founded in 1848 by the Rev. Canon Woodard, M.A., the first stone of the central building being laid by the same gentleman in 1854.

Situated on the Downs, near North Lancing, the college, fig. 1, is built of dressed flint, with enrichments of stone; in plan it forms two quadrangles with surrounding cloisters. The east quadrangle is completed by the headmaster's house and dining hall. The foundation stone of the building to complete the west quadrangle was laid by the Marquis of Salisbury in 1910. The chapel, fig. 3, is of dressed freestone in the early English Gothic style, consisting of nave and aisles with an apsidal east end. It was dedicated in 1911, since when numerous improvements and alterations have been made at the college. They include a chantry chapel in memory of the founder, and a new electrically-operated organ, costing £3,000, added in 1914-15; a new wing added and taken into use in 1912; further extensions, including masters' quarters in a 70-ft. tower, with dormitories and studies, forming a sixth house, made in 1913; and finally—most important of all from an electrical viewpoint—the whole of the college buildings were, in 1927, wired throughout for electricity.

The electrical installation was designed and carried out with the Henley Wiring System by Messrs. F. A. Barnes & Son, local contractors, the total number of lighting points being 1,270. The chapel organ is now blown by a 10-h.p. motor manufactured by "Cromptons" and fitted with an automatic contactor-type stator and rotor starter, which is controlled by a start-and-stop switch fitted to the organ manual. For experimental purposes, charging accumulators, &c., a "Hewittic" rectifier with a d.c. output of 15 A at 100 V is installed in one of the laboratories, and the motive installation is completed by a 10-h.p. motor for driving laundry machinery and various small motors for refrigerators and vegetable machines in the kitchens. Some 17,700 yards of twin and triple "Henley" cable—from 3/.029 upwards—was used for the lighting. The main l.p. switchboard was supplied by Messrs. Dorman & Smith, Ltd., and consists of iron-clad switchgear on an angle-iron frame. It is equipped with bus-bar chambers, three ammeters, one voltmeter with a 3-way switch, three 100-A, one 50-A and five 20-A switches and fuses.

The main switches, distribution boards and electric light fittings were supplied by the General Electric Co., Ltd., whilst the lighting switches, switch-plugs, &c., were supplied by Messrs. J. A. Crabtree & Co., Ltd. All the lamps are of from 20 to 300 watts, and special floodlight projectors in the chapel were supplied by the British Thomson-Houston Co., Ltd.

Current is supplied at 8,000 V by the Shoreham & District Electric Lighting & Power Co., Ltd., and is conveyed some 4,000 yards at that pressure by Henley 3-core .04-sq. in. cable from Shoreham sub-station to the college. There it is transformed to l.p. and is distributed all round the college by 1,650 yards of Henley l.p. paper-insulated, lead-sheathed and armoured cable of various sizes.

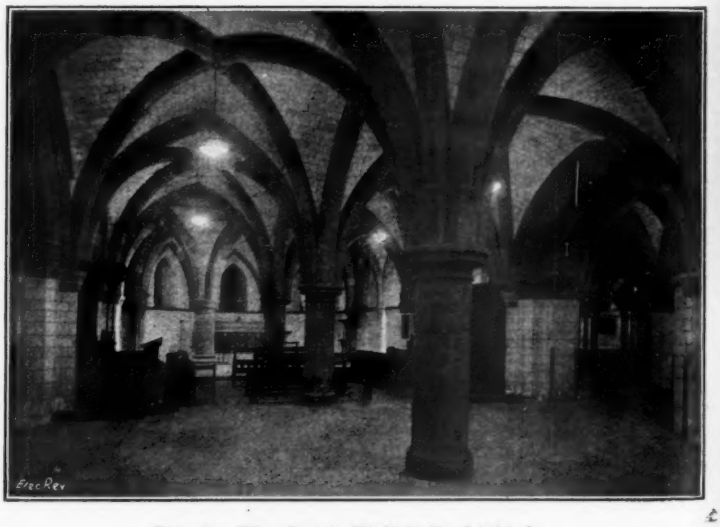


Fig. 2.—The Crypt, Electrically Lighted.

The lighting of the chapel, fig. 3, is carried out similarly to that of Peterborough Cathedral (ELECTRICAL REVIEW, January 1st, 1926, p. 19) by means of silvered-glass projector

fittings, with 250-W lamps, mounted on adjustable arms fixed in the triforium, and so adjusted that the beams of light are trained towards the bottoms of the piers on the opposite sides of the nave. At the east end of the chapel one projector on either side is directly focused on to the altar. Each projector has a small adjustable mirror on the underside, that throws some of the light upwards, so as to illuminate the upper part of the walls and the roof. The height of the chapel from the floor to the groined roof is 90 ft.; the projector units are fixed 54 ft. from the floor, and well back in the triforium arches, so that by day they are not noticed.

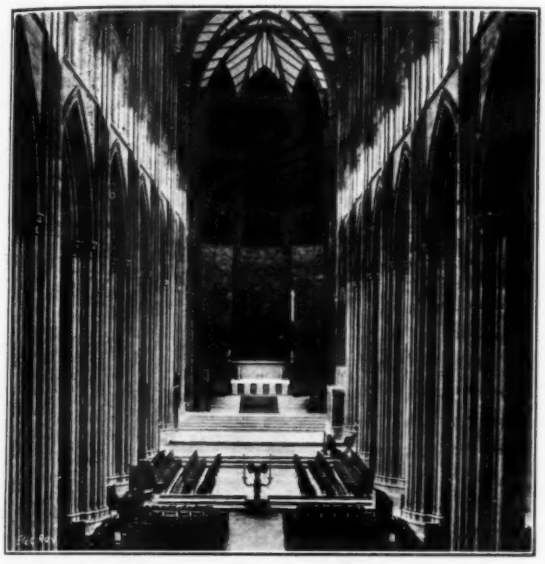


Fig. 3.—The Chapel, by Artificial Light.

The main cables enter the chapel at the west end of the crypt in a portion that is used for the organ motor and "Discus" blowers; the main switches, meter and main distribution board are also fixed in this part. The lighting cable is carried up from the main board into the vergers' store or

Fig. 4.—Founder's Chapel, Electrically Lit.

cupboard under the organ loft, where are fixed the distribution board and switch panel controlling all the lights. The cables are carried up through the organ loft and into the triforium on either side to the various units, so that they are not visible to the congregation. The crypt, fig. 2, is lighted by enclosed pendants, while the altar and founder's chapel, fig. 4, are lighted by a number of Mirolux reflectors, each having two 40-W lamps, fitted on the capping of the columns, &c., practically out of sight.

Mr. A. M. Willey, engineer and manager of the Shoreham and District Electric Lighting & Power Co., Ltd., acted on behalf of the College authorities as clerk of works during the progress of the installation.

It is of interest to note that in 1926 Messrs. Barnes & Son carried out a complete installation with the same wiring system at the Shoreham Grammar School.

H.P. Direct-Current Generators.

Some particulars of Swiss machines that generate up to 12,500 volts with a single commutator.*

CONSIDERABLE advances have recently been made in the design of high-voltage d.c. generators for energising the anodes of wireless transmitting valves. Since 1912 the S.A. des Ateliers de Sécheron, Geneva, Switzerland, which constructed the first of the well-known Thury generators used for the series transmission of power, had erected some twelve Thury installations, using voltages up to 4,500 V per commutator. Of course, such machines differed considerably from the modern anode generator: for instance, the insulation difficulties were considerably reduced by the large size of the machine (up to 1,000 h.p. each) and none of the refinements for the reduction of ripple had to be incorporated in them. As early as 1916 the firm had constructed a 4-machine set developing 12,500 volts per commutator, the four commutators being used in series to produce 50,000 volts for a radio-telegraph spark transmitter, and it has since been used with a valve transmitter with entirely satisfactory results.

The mechanical construction of the machine is identical with that of normal generators, fixed magnets with rotating slotted armatures being employed and either the slots or the pole edges skewed. Two-polar machines are avoided, chiefly because they do not lend themselves to the easy mounting of former-wound coils, which are almost essential for safe insulation. The whole of the insulation from the frame is concentrated in the slot itself and not partly in the slot and partly between the armature iron and armature spider, as was the case in the earlier Thury machines. The use of two commutators in series on a single armature is also avoided, as the insulation between the two windings offers considerable difficulty. The number of slots and commutator segments is made as large as possible, but the electrical loading (ampere-conductors per inch of periphery) is kept comparatively small with a view to satisfactory commutation and cooling.

One of the most important questions affecting the design of such machines is the break-down voltage to which they are to be subjected during their test. Oscillographic experiments made on a 10,000-volt 2-ampere generator showed that if the full load was rapidly broken by means of an oil switch the voltage at the terminals might rise momentarily to 1.8-2.1 times the normal, but if a horn-break switch was employed the voltage rise was only 1.3 times the normal, so that by the use of a suitable by-pass composed of condensers and resistances it was found possible to reduce the voltage rise (even with oil switches) to only 1.1-1.2 times the normal, but such by-pass circuits are not desirable from the point of view of simplicity.

At one time a test pressure of (2×working voltage+plus 1,000) volts (d.c. voltage) was considered sufficient, but it has been gradually raised and a safe value would now appear to be (2×working voltage+5,000 volts). In practice such high direct-current voltages are not usually available and the test is, therefore, carried out with 50-cycle a.c. voltages obtained from static transformers. Early experiments seemed to show that approximately equal stress was involved if the 50-cycle a.c. test voltage was 50 per cent. of the d.c. test voltage, and later experience has shown that at any rate 60 per cent. is a safe equivalent to use. That is to say, the a.c. test voltage (r.m.s.) should equal (1.2×working voltage+3,000 volts). If much more than this is employed the machine has to be considerably enlarged, with a consequent considerable increase in cost and decrease in efficiency.

The slot insulation between mounting and frame takes the form of micanite tubes pressed round the coils and very low slot space factors have to be allowed for in consequence. For instance, a 12,000-volt, 1-ampere generator will have a slot space factor of (total copper sections in slot divided by gross slot area)=0.035, or 3.5 per cent. approximately for practical purposes.

The shaping and insulation of the coils demands great care and experience, and can only be carried out by highly-skilled workmen trained for the purpose. The insulation outside the slot is less important and simpler. The end windings are supported on metal seatings covered with bakelite cylinders. The thin wires of the armature coils are not carried direct to the commutator, as to do so would involve too much risk of breakage; instead a piece of stronger stranded wire is soldered to the commutator at one end and to the coil ends at the other and bound-in securely to the coil itself.

The commutator segment insulation is provided by micanite

* *E.T.Z.*, October 18th, 1928. Machines for a similar duty are made in England by Newton Brothers (Derby) Ltd., and the British Thomson-Houston Co., Ltd.

or amberite having a thickness of from 1.5 to 3.5 mm., according to the voltage per segment, the latter thickness being sufficient for a machine carrying as much as 250 volts per segment. Very hard carbon brushes are used and commutating poles are provided, being insulated with micanite tubes from the frame, and half of them are connected in the positive main and half in the negative main. The excitation of the h.p. generator is generally provided by a separate 110-V exciter. The experience gained with the 12,000-volt machines has convinced the makers that similar ones giving 20,000 volts (which covers the highest present requirements for anode supply) are quite feasible, but only in sizes of 20 kW, or over, *i.e.*, if smaller powers were required the same size of machine would still have to be employed.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Heating System.

A system of heating introduced by Messrs. S. G. LEACH AND CO., LTD., 26-30, Artillery Lane, E.1, for which claims of efficiency and economy are made, employs one or more "Modine" units. One of these is shown in fig. 1. It consists essentially of three parts, a condenser, a frame and manifold, and an electric fan. Steam or hot water is fed to the condenser and its heat is given up to air driven over the condenser baffles by the fan. On a steam system the maximum pressure required is 10 lb./sq. in. It is claimed that the units spread the heat without any noticeable draught.

Small Breaker with Time-delay Attachment.

In the "Elimafuse" small circuit breaker marketed by INDUSTRY & COMMERCE ALLIANCE, LTD., 55-59, Kingsway, W.C.2, the difficulty on some circuits of the "starting" current tripping the breaker has been overcome in two appropriate ways. In one the adjustment which determines the tripping current is combined with a bi-metallic thermal element of simple form, which enables the circuit breaker to carry up to about ten times its rated current, for a strictly limited time, after which the tripping value is automatically reduced to one that is safe for the circuit conductors. This feature does not, it is claimed, noticeably diminish the speed of operation in the event of a "short-circuit." Fig 2 shows the thermal time-delay element and its attachment to the spring which controls the tripping current. The thermal element tends to straighten as its temperature rises, thus diminishing the spring tension. The other method employs a button which must be pressed home during the initial period. The pressure permits of increase in the tripping current up to from five to eight times the full-load current. Relieving the pressure on the button restores the circuit breaker to its standard rating. This arrangement thus overcomes in a simple manner the serious risk of short-circuiting the fuses during the starting period. The double- and triple-pole "Elimafuse" circuit breakers are so constructed that if there is excess current sufficient to operate one pole, the circuit is opened on all poles simultaneously. The breaker is supplied in all ratings up to 25 A. It will reliably interrupt, it is claimed, a short-circuit current of 1,500 A at 275 V d.c. The apparatus, without the time-delay device, is similar to that described in the ELECTRICAL REVIEW of June 29th, 1928, p. 1159.

Fig. 1.—"Modine" Heating Unit.

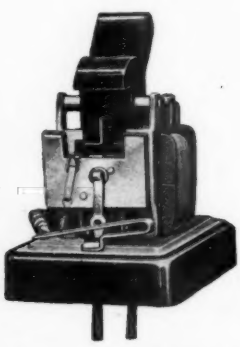


Fig. 2.—"Elimafuse" with Thermal Time-delay Element.

Naval Wireless Transmitters.

A new series of valve transmitters has been designed and introduced by MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, W.C.2, for use in naval vessels. Types TN1 and TN2 transmitters, with aerial ratings of 2 kW and 1 kW, respectively, are for continuous and interrupted-continuous-wave signalling. Telephony transmission can be provided for if required, without increasing the overall dimensions of the transmitter. Interrupted-continuous-wave signalling can be effected on either one of three selected note frequencies, thus allowing distinctive notes to be used by different ships working on the same wavelength. The provision of a master oscillator, or independent drives, enables constancy of wavelength to be maintained, while the absorber system of keying gives stability of working and eliminates "key clicks," thereby rendering the set particularly suitable for duplex working. The standard transmitter is designed to cover a wave range of from 400 to 3,000 metres, and any wavelength within this range can be quickly brought into use by controls mounted on the front of the transmitter. The whole of the transmitting apparatus is mounted in a steel framework enclosed by metal panels and safety screens, and all tuning circuits are adjustable by handles calibrated in wavelengths and mounted on the face of the panels. Access to the inside of the transmitter is obtained through a safety gate in the front. Fig. 3 shows the TN1 transmitter. Type TN4 transmitter is a fire-control transmitter for destroyers, cruisers and battleships, and is designed to provide an efficient means of communication between the vessels of a flotilla or squadron, and with aircraft operating in conjunction with the fleet. It is suitable for signalling by continuous waves, interrupted-continuous-waves, and telephony, and all adjustments and operating controls are mounted on the front of the transmitter, thereby allowing instantaneous change of wavelength and change from one system of signalling to another to be made. The transmitter is nominally rated as a 500-W set, which is the output of the h.p. d.c. generators to the anodes of the valves. The wave range of this type is from 80 to 180 metres, when used on an aerial approximately 40 ft. long. For short-range telegraph communication over about 50 nautical miles, on wavelengths between 100 and 150 metres, the type TN5 transmitter has been designed. The output of the h.p. d.c. generator used for supplying power to the anodes of the valves is 120 W, which is taken as the nominal rating of the set. Another compact low-power telegraph transmitter is the type TN5a, which forms the main transmitter in such small craft as tugs, naval pickets, and motor boats. The set is designed primarily for interrupted-continuous-wave signalling on an audio frequency of approximately 600, 900 or 1,200 cycles, but it can also be used for continuous wave signalling.

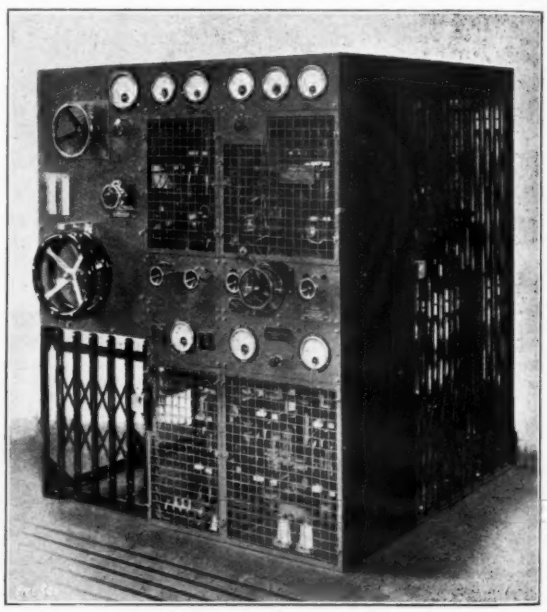


Fig. 3.—TN.1 Naval Radio Valve Transmitter.

Domestic Electrical Appliances.

New Cooking, Heating, and Cleaning Devices for use in the Home.

New Electric Cookers.

A range of electric cookers has recently been introduced by the MANOR ELECTRIC OVEN & FIRE CO., 303, High Road, Chiswick, W.4, which embody several new features. The oven door, front frame, and drop-down door to the grill chambers of each cooker are fitted with porcelain tiles. The switches and fuses are protected and mounted on a patented vitreous-enamelled splash back, and the hot-cupboard or grill chamber is fitted with a vitreous-enamelled mild-steel interior. The hob

Fig. 1.—Small "Manor" Cooker.

is vitreous-enamelled mottled grey, and the hot-plate, grill, and oven elements are of the "plug-in" type.

The boiling plates are new in design, and consist in the 2-kW plate, of twelve non-oxidising metal tubes which run visibly hot. The tubes are so arranged that the utensils rest evenly thereon. The 2-kW plate has an efficiency of 52 per cent., and the combined grill and boiling plate 48 per cent. In a cheaper cooker vitreous-enamelled door panels are used in place of porcelain tiles. Fig. 1 shows one of the smaller "Manor" cookers.

A recent introduction of the JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1, is the "Jackson Junior," fig. 2, which has been designed primarily for use in rural areas. It is made of cast-iron and steel, and the exterior black parts are stove enamelled, except the hob, which is "Marblon" mottled enamelled in leadless vitreous enamel.

Fig. 2.—The "Jackson Junior" Cooker.

The overall dimensions are 22½ in. high by 19½ in. wide by 15½ in. deep, the oven cooking space being 10 in. high by 13 in. by 13 in. The hob contains a 9-in. by 7½-in. grill-boiler plate, with a grill space of 10 in. by 8 in., which, it is claimed, will keep four large saucepans boiling, and toast, or grill, at the same time. An important feature is that the grill-boiler plate is quite independent of the oven, thereby avoiding the difficulties often associated with small cookers in which the grill is incorporated with the oven. The cooker may be stood on a low bench, shelf or table, or a set of cast-iron legs with a pot rack may be provided. It is claimed that this cooker will give all the results obtainable with the larger Jackson models. The loading of the grill-boiler plate is 1,800 W, and of the oven 1,360 W.

A Self-Regulating Safety Kettle.

A new electric kettle recently introduced by METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester, is equipped with, in addition to the "Met-Vick" automatic "spring-clear"

Fig. 3.—"Met-Vick" Self-Regulating Safety Kettle.

device for preventing damage to the kettle if it is accidentally switched on dry, an arrangement which can be automatically regulated so as to cut down the current at a predetermined temperature of the water to a value which will gently bring the water to the boil and maintain it there, thus preventing splutter or overflow from the lid or spout. The kettle has three heating elements, each of 350 watts. One of them is permanently connected to the terminals of the kettle, while the other two are connected to the main terminals through a small 10-A mercury switch, which makes or breaks the circuit when tilted one way or the other. This switch is mounted by means of a spring clip on a helical spring made of bi-metal strip about ¼ in. wide, which tends to uncoil itself when heat is applied. The mercury switch is so mounted on the free end of the spring that the rotation of that end tilts the switch into the "on" or "off" position. The other end of the spring is fixed in a tube, which is capable of rotation (for adjusting purposes) in an outer tube, the latter projecting into the kettle near the bottom. As the water gets hotter, the spring uncoils itself slightly, the free end rotating in a clockwise direction. The adjusting lever is set so that just before the water boils the mercury switch breaks contact, leaving only one element in circuit, which is sufficient to keep the kettle boiling gently. If the kettle is switched off and allowed to cool down, or is refilled with cold water, the spring coils itself up again, causing the free end to rotate in an anti-clockise direction, thus tilting the switch the other way and making contact again. The device is robust and, it is claimed, absolutely positive in action. The mercury switch is housed in a projection of the kettle case at the back, near the connector plug at the bottom, as shown in fig. 3. Fig. 4 shows the switch unit to a larger scale.

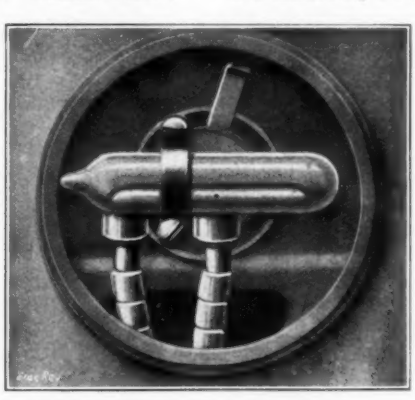


Fig. 4.—Mercury Switch Unit.

H.P. Distribution Protection.

A descriptive account of the novel protective apparatus that has been devised for use on the high-voltage distribution network of the Lothians Electric Power Co.

By H. C. BABB, M.I.E.E.

(*Extracts from Paper read before the* EDINBURGH ELECTRICAL SOCIETY.)

FOR serving areas of from 800 to 1,000 square miles the present most popular system seems to be a.c., 3-phase, 50-cycle, purchased in bulk through a 33,000-volt main ring line (Edinburgh Corporation) principally overhead, on steel or wooden poles, feeding a number of main transformer sub-stations, the length of the ring being anything up to fifty miles; from the sub-stations, distribution lines at 11,000 volts, generally overhead, radiate over the district to small sub-stations in, or near, the larger towns that reduce the voltage to 10,600 V, 3,000 V, 400 V, and 230 V, necessary to serve as many consumers as possible at the minimum cost. Obviously to extend the low-voltage mains from the distribution points to feed isolated consumers, the cost would be excessive and the loss in the overhead lines, or cables, would be prohibitive; therefore, outlying consumers have to be fed from the high-voltage distribution lines, which are usually at 11,000 volts, through transformers attached to nearby poles.

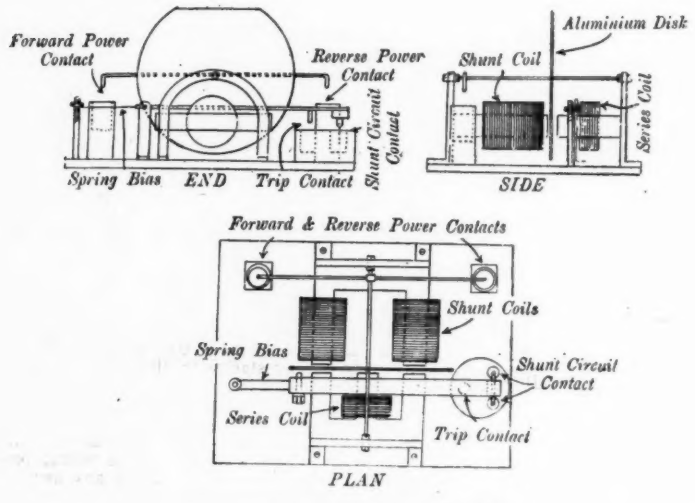


Fig. 1.—Experimental Model Selector.

In the case of a straightforward 11,000-volt line open at one end, if short, an overload switch will protect it satisfactorily, but if it feeds several sub-stations it is not always satisfactory to use more than a 5-amp. time-limit fuse in the protecting switch and with such a small fuse the grading presents great difficulty; morevover, complications are caused by reverse power when a ring main has to be dealt with.

When the Lothians Electric Power Co. met with these problems the several types of then existing protective gear were examined, but none of them would exactly satisfy all our requirements. I decided that it was possible for apparatus to be designed to afford protection under practically every condition, with the added advantage that no pilot wires would be required, which give far more trouble than the whole of the rest of the protection gear, besides their cost of installation amounting to something like £100 per mile. After considerable research and experiment the "Lothians protection gear" was made, and it is claimed that with the exception of impedance relay protection gear, which is to be used on the Central Electricity Board's 132,000-volt rings (and of which I know little) it is the only one which will satisfactorily protect high-voltage lines that are tapped indiscriminately without using a time lag, which holds the fault so long that it becomes dangerous.

For sectionalised ring-main protection there is no alternative but to use apparatus that will discriminate. The "Lothians gear" timing of the various overload relays is entirely independent of the value of the fault current, and is so arranged that each instrument when set in motion at the moment of the occurrence of a fault will run at precisely the same speed, thus giving very close tripping times between each successive sub-station in which it may be fixed, independent of any number of tappings of the line between sub-stations.

Operating Principle.—Timing the operation of the switches is accomplished by arranging the various lag contacts, both forward and reverse power, relative to each other in such a way that on a ring main from the supply point outwards in both directions the forward-power time lag successively decreases and the reverse-power time lag successively increases. Utilising this principle, apparatus consisting of a "selector" (or directional relay of special construction) and an "operator" (or overload time delay instrument) both interconnected electrically, is used.

The Selector.—Purely for discriminating in which direction the power is flowing, it works on the principle of the alternating-current wattmeter (figs. 1 and 2). An aluminium disk mounted on a spindle is arranged to be partially rotated in either direction by the magnetic field produced by a shunt magnet on the one side and a series magnet on the other. On the spindle are two tripping contacts, one "forward" and the other for "reverse" power, so that according to the direction in which power flows so will one or the other, but not both, contacts be closed. In addition, two others are closed when the current exceeds a predetermined value, the common trip contact being connected in series with the former two on the spindle and disk, the fourth completing the shunt circuit; all of which, except the latter, are in the tripping circuit operated by a battery. The function of the common contact is to break the tripping circuit immediately the excessive fault current ceases to flow, the reason for which will be explained later; the fourth contact allows the shunt circuit of the selector to be energised immediately the current, due to a fault, exceeds a predetermined value.

Under normal conditions the shunt coils of the selector are not excited; therefore no current is used and the shunt coils can be designed for a very heavy current rating, so that in the event of a big fall in pressure due to a severe fault the flux of the shunt magnet will still be sufficiently strong, in conjunction with the series flux, to cause the aluminium disk to rotate and so make one, or the other, of its tripping contacts. It should be pointed out that there might not be any serious drop in pressure, except on a three-phase fault, across the shunt coils mounted on the selector, which is in the faulty phase, because while the series coil is in one phase its corresponding shunt coil is connected to one of the other two phases. Another advantage of keeping the shunt coil "dead" is that existing instrument potential transformers can be used without overloading them and possibly upsetting other instruments connected thereto. Where power transformers are already in-

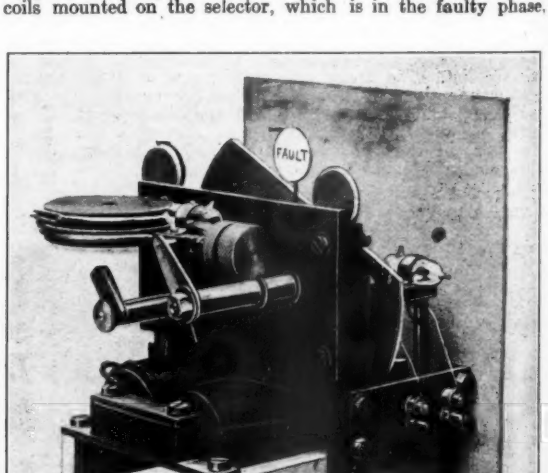


Fig. 2.—Switch Selector.

stalled they can be used to avoid the cost of installing separate potential transformers.

The Operator.—The time-lag device is set in motion when the current exceeds a predetermined value, after a predetermined period of time (which is entirely independent of the value of the fault current) and completes the tripping circuit, or, if the fault is cleared sooner, automatically returns to its normal zero position.

It consists (figs. 3 and 4) of a light metal disk having ratchet-like teeth on its periphery, mounted on a spindle and free to make one complete revolution; two arms, one on each side, which can be adjusted by placing them in any of a series of holes round the disk, are adapted so that each will close a tripping contact, one for "forward" and one for "reverse" power, connected in series with the selector. On the same spindle are two pulleys to which are attached fine cords: from one of them is hung a light plunger in a dashpot containing oil, the viscosity of which is not appreciably affected by changes of temperature, its function being to control the speed

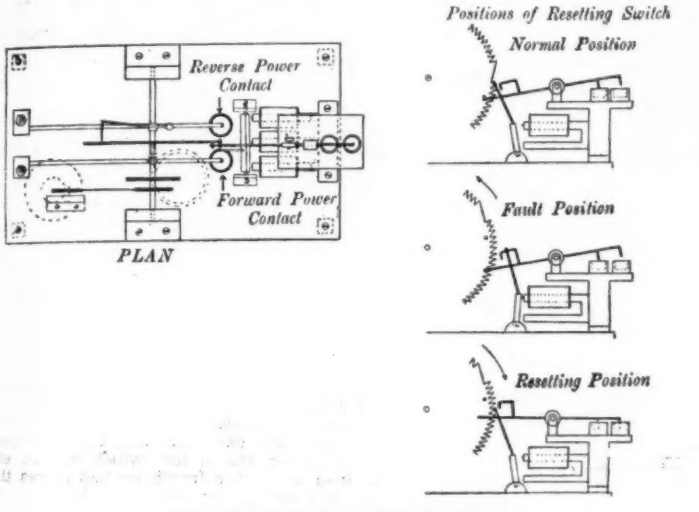


Fig. 3.—Experimental Model Operator.

of the disk, which is (in our case) about one revolution in two seconds, but can be varied to suit specific requirements; to the other cord is attached an iron core inside a solenoid, which is energised by the tripping battery, its function being to overcome the weight of the plunger and thus cause the disk to rotate in a forward direction when released by the fault current. After the fault has been cleared the solenoid is energised, thus causing the iron core to be lifted; the weight of the plunger in the dashpot then causes the disk to rotate in the reverse direction and so assume its normal position ready for another fault.

During normal conditions the disk is held in its zero position by a pawl engaging with the teeth in the disk. Attached to the pawl is an armature controlled by a bias weight, or spring: when a fault occurs the armature is pulled over, thus allowing the disk to rotate until the fault clears itself, or the switches open, when the pawl on the armature again engages and stops further disk rotation in a forward direction. The armature is energised by one, or more, of four coils, three of them connected one in each phase, and the fourth in the neutral to function for "earth" faults only; it is made very sensitive, as normally little current flows in the neutral.

Mounted near the pawl is a contact which is held open by a pin in the disk when the latter is in its normal position. Immediately the pawl is released from the disk by excessive current, the pawl takes over the duty of holding the contact open. When the fault has been cleared the pawl allows the contact to close the solenoid-resetting circuit, which causes the disk to return to its zero position and the contact to be opened again by the pin in the disk.

Action of Selector.—The selector's two contact arms are normally held open by the gravity control of the disk. When the fault current suddenly ceases the disk will tend to swing over and so make the other contact, which may under certain conditions trip the wrong switch; but, since the shunt and tripping circuits are broken simultaneously on the selector, no complications can occur should the disk momentarily swing over. It is due to this contact and the purely mechanical timing, that the "Lothians" system can give such fine time settings between successive instruments.

Use of Protection Gear.—On an open-ended main, since there can be no reversal of power, operators only are required.

On parallel feeders operators only are required at the feeding end, with a very short time-lag setting. At the remote end selectors only are required, set without any time lag, so that they function before the operators.

On a ring main when two switches are installed in each sub-station (incoming and outgoing) one switch would be on the forward setting and the other on the reverse, but only one set of selectors and one operator are required. Only three current transformers are required to operate the apparatus when two switches are to be controlled, except at the supply point, where one operator is fitted to each switch, but without selectors. When there is only one switch in each sub-station the operator can be given two distinct time settings, one for forward and one for reverse power.

The tripping of the switches and resetting of the operator are carried out by direct current supplied from a battery provided for that purpose in each sub-station.

On the selector is an indicator that shows which phase has been, or is still, faulty, and also in which direction the fault lies. On the operator an indicator shows how far the disk has revolved before clearing the fault, and (knowing the settings of the various instruments) it is possible to ascertain which switch has tripped by visiting any one of the sub-stations, because all the indicators will read the same as the one in the sub-station in which the switch has tripped; all indicators have to be reset by hand. Across each tripping contact of the operator is connected a small hand-operated time-lag cut-out switch: when closed, before re-closing a switch which has been tripped by a fault, it causes practically instantaneous tripping should the fault still be on.

When designing the apparatus our aim was to obtain absolute mechanical timing with close setting between each successive instrument: for example, we have had for over 12 months four sets on a ring main eleven miles long, with a maximum time lag at the supply point of 0.64 second; they were made by our staff with the assistance of an outside instrument maker. Out of fourteen faults caused by birds and tree branches, the first four were not cleared in proper sequence, owing to adjustments which could only be carried out after noting practical conditions; the fifth cleared itself before any switches tripped, and the last nine faults have been cleared in proper sequence. When a fault occurs on a ring main fairly near the supply point, the instruments on the long section of the ring do not usually commence to function until

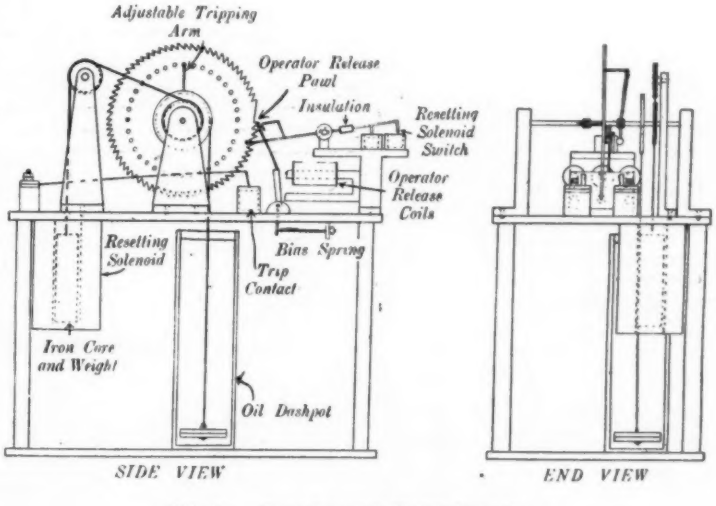


Fig. 3a.—Experimental Model Operator.

the short section has been cleared, due to the fall in pressure being insufficient to cause heavy current to flow round the long section until the pressure rises after the short section has been cleared. This fact, however, does not affect the working of the apparatus.

Action During a Fault.—The sequence of function is as follows (fig. 5):—Suppose an earth fault on blue phase: corresponding current will be induced in the secondary winding of transformer 36 and flow through selector series coil 6, which will then cause switches 35 and 33 to close; simultaneously coils 24 and 24*a* will release the operator. The closing of switch 33 will allow the shunt coil 5 to be energised from

potential transformer 7, the combined effect of coils 5 and 6 causing contact 4 to close. When the time lag of the operator has elapsed. contact 29 will complete the d.c. tripping circuit through trip coil 31 (from battery 30) when the main oil switch 1 will break the fault current induced in the current transformer secondary 36. Switches 35 and 33 will then open the

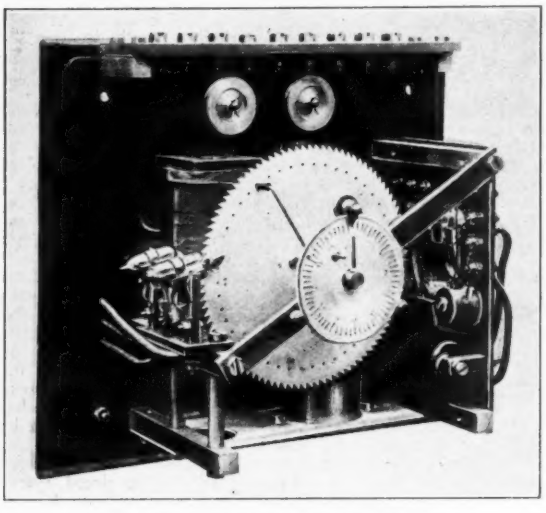


Fig. 4.—Operator Time-lag Device.

trip circuit and shunt coil 5, causing contact 4 to open; simultaneously the operator will stop and resetting contact 26 close, thus energising resetting coil 22 from battery 30. The operator will then return to its normal position and resetting contact 26 open, thus cutting off the current to the resetting solenoid.

Should the power to the fault be in the opposite direction the sequence of operation will be the same, with the exception that contacts 4*a* on the selector and 29*a* on the operator will be closed, thus energising trip coil 31*a* and opening oil switch 2.

If the fault is cleared by another switch on the line the apparatus will return to its normal position for further use should another fault occur.

Commercial Model.—The commercial manufacture of the apparatus has been undertaken by a company in Scotland, which, after thorough investigation and inspection of the original in operation, was satisfied that the apparatus will effectively protect a distribution main against all descriptions of fault and indicate the section on which the fault occurs, without the consumption of power except when functioning; also it will indicate the nature of faults at a cost which is infinitesimal, compared with that of existing apparatus on the market with which pilot wires have to be used; above all it allows load to be taken off at any point of the line, thus allowing transmission lines to be used to their fullest extent.

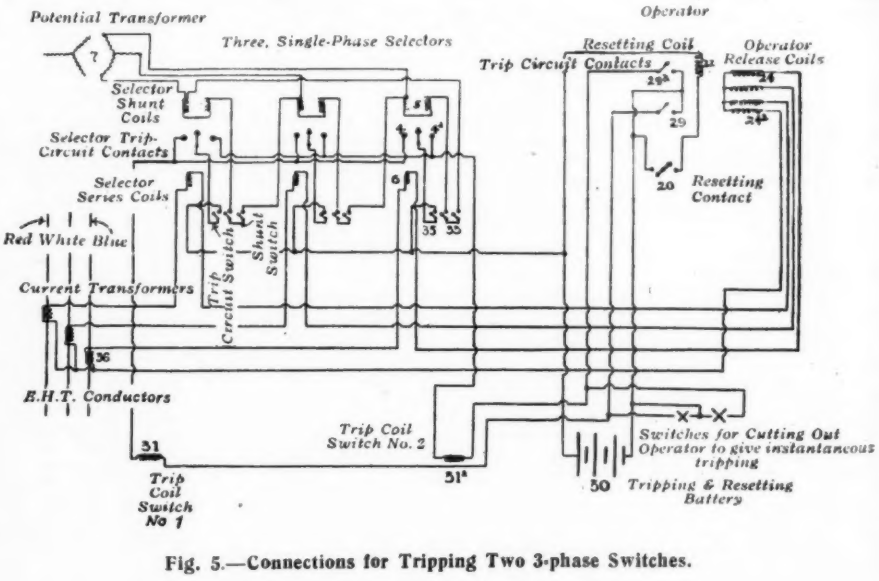


Fig. 5.—Connections for Tripping Two 3-phase Switches.

German Million-Volt Testing Plant.

An open-air million-volt testing plant has recently been established by the Bergmann Electricitätswerke Gesellschaft, at its works in Berlin. The plant is intended for the testing of transformers, insulators, &c., constructed for outdoor use. The installation consists of three transformers connected up on the Dessau system so that at the end terminals a pressure of a million volts is obtained. The Bergmann Co. has already a half-million volt testing plant, which in future is to be used for the testing of insulating and allied materials.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

Earth or Insulate?

May I hasten to assure Mr. Crowdy that my letter was written in the same strain as his own, and to grasp his outstretched hand with all good wishes for the coming year? We must have these little bits of fun occasionally, and I am only too happy to withdraw any hard words that are not, perhaps, in the best of taste.

I still think that I should have preferred to see the conductor under discussion enclosed in a flexible metallic tube in the same way as the metal-pot conductors, but no doubt Mr. Crowdy has the best of reasons for not doing so.

May I also thank you, Sirs, for your good wishes, and hope that our REVIEW may prove even more useful to us in the future than it has done in the past—which is, in the language of our American cousins, "saying a mouthful."

T. C. Gilbert.

Folkestone, *December 29th*, 1928.

Lamp Trading.

The trade generally, I venture to believe, would like the E.L.M.A. to define clearly the dividing line between *bona-fide* electrical traders and others: whether, for instance, the line is to be drawn at piano dealers, leather goods merchants, or paper hangers. Representative businesses of these three mentioned trades are trade-graded in this city.

What with shopkeepers *ad lib* being allowed (*sub rosa*) discounts on parcels of one dozen lamps or so, and other "snatch order tactics," the sales, in relation to output, passing through legitimate trade channels get smaller year by year.

Upon asking for lamp orders at their own installation jobs, contractors are often told that their customers buy elsewhere at a discount—a very galling experience for one who merely asks for that which he, naturally, expects.

Is it not time that the whole business was seriously reviewed, and "rules and regulations" adjusted a little more in favour of those looking (perhaps unfortunately) to the trade for a living?

J. H. Noble,
(*Director*) ELECTRO-MECHANICAL SUPPLIES, LTD.

Coventry, *December 28th*, 1928.

Thermal Efficiency.

We hear a good deal about the thermal efficiency of electricity generating stations, and it would be interesting to know just what is intended by that expression. Is there any authoritative formula for it? and is the same formula used by all stations in making their returns? What about the power used in the station itself for the numerous auxiliaries, coal and ash conveyors, pulverisers, pumps, fans, &c.? Is this debited or credited? What is the position in this respect of a station with steam-driven auxiliaries, as compared with one all motor-driven? The power used up by the auxiliaries in a modern supply station must be a considerable percentage of the total.

M.I.Mech.E.

December 29th, 1928.

Wind Pressures.

Referring to the extracts from a paper by Mr. W. B. Woodhouse on Overhead Lines before the I.E.E., in the ELECTRICAL REVIEW of November 16th, the following data observed here during the hurricane of September 15th-16th, 1928, may be of interest.

The pole line in question was constructed of 33-ft. Bates expanded-steel lattice poles (an American product), with concrete foundations 4 ft. in coral rock, and failed by bending through an angle of 90 deg. about 8 feet from the ground.

From a consideration of the exposed area of the poles and lines and the manufacturers' actual tests at which failure occurs, it was apparent that the wind pressure exceeded 66 lb. per square foot.

The failures were not isolated cases which might have been attributed to faulty poles, but occurred to groups of poles in three different localities.

The anemometer failed when registering 98 m.p.h., but the wind velocity further increased to an estimated anemometer reading of 125 m.p.h., giving an actual wind velocity of approximately 94 m.p.h., accompanied by torrential rain. It appeared that the maximum pressures were due to "eddies" or streaks in the main gale, which caused exceptional conditions in particular localities; while large structures might only be loaded to an average value, small structures are more liable to be wholly loaded at the maximum pressure and consequently suffer greater damage.

While laboratory tests in tunnels with dry air are productive of interesting and useful data, the conditions are hardly comparable with gale conditions when the atmosphere is heavily laden with rain, which, by virtue of its increased mass, must produce considerably greater pressures on exposed structures. It is suggested that more extensive observations of actual wind (and rain) pressures under gale conditions would be of much service to engineers responsible for line construction, as figures of wind velocities convey little information regarding the maximum loading likely to be encountered

C. H. Brazel, A.M.I.E.E.,
Director, Electrical Department.
Nassau, Bahamas, *December 15th*, 1928.

British and Foreign Switchboard Ammeters and Voltmeters.

Extracts from a synopsis of a detailed report by the British Scientific Instrument Research Association.

WE have received from the British Scientific Instrument Research Association a summarised report on an investigation, initiated by the Association at the request of certain of its members, who desired to obtain an impartial criticism of their switchboard instruments, with a view to improving their designs, and an impartial comparison between their instruments and those of other manufacturers, with a view to discovering whether there was any foundation for statements, not infrequently met with, that the instruments made by certain foreign manufacturers were the "best" obtainable.

The inquiry was confined to permanent-magnet moving-coil instruments, new instruments being obtained from the best-known British and foreign manufacturers. The examination has led to slight modifications being made in certain British instruments in respect of the degree of damping provided and the details of scales. The best of the instruments examined, both British and foreign, are stated to be well suited to the purposes for which they are made, and none of them shows an outstanding superiority over all the others in every particular. The instruments made by two British manufacturers are open to criticism in respect of some details of construction, while the instruments made by two foreign manufacturers are distinctly inferior both in design and construction to any of the other instruments examined.

"It can definitely be stated, as the result of the examination, that the instruments made by certain of the principal manufacturers in this country are not inferior to any comparable instruments of foreign manufacture; and that in what may be termed the general 'balance' of design some of the British instruments take a leading place."

The types of instruments selected were the ordinary "Dial Type" switchboard ammeters and voltmeters, of from six to eight inches diameter, obtained from 12 of the best-known British, American, and Continental sources, the number of different instruments being twenty-three.

Some extracts from the report are given below:—

Rapidity of Indication.

The instruments examined differed widely in the extent to which the movement of the pointer was damped, as the result of which there was a wide variation in the time taken for the pointers to come to rest after a current, sufficient to produce a deflection of about 90 per cent. of the full deflection, had been switched on through the instrument. In some of the instruments the pointer struck violently against the stop at the upper end of the scale. In one or two instances, also, there was a tendency for the movement to stick at the upper end of the scale. In other instruments the pointer oscillated several times before coming to rest.

The damping should be almost, but not quite, critical, *i.e.*, it should allow the pointer to swing slightly beyond the position it will finally take up, and to return fairly quickly to (and actually through) that position, after which the movement should be imperceptible. Certain of the instruments, both of British and foreign manufacture, were admirably proportioned in this respect. Two others, of British make, were modified by their makers in order to demonstrate that it was quite a simple matter to adjust the damping to any desired degree.

Accuracy.

Of the instruments examined, about 60 per cent. were accurate to within 1 per cent. at ordinary temperatures, 30 per cent. had errors between 1 per cent. and 2 per cent., 8 per cent. had errors between 2 per cent. and 3 per cent., and one instrument had an error of over 9 per cent.

The general level of accuracy of the British instruments was at least as high as that of the foreign instruments.

Correction for Temperature.

Most of the voltmeters were fairly accurately corrected for temperature variation.

The ammeters were not, in general, provided with compensating coils, but the variation of sensitivity over a range from 10 deg. to 50 deg. C. was not usually greater than 3 per cent. Three ammeters, two British and one foreign, were fitted with compensating coils. In one of the British instruments the compensation was practically perfect from 10 deg. C. to 50 deg. C., the sensitivity of the instrument being constant to within one or two parts in one thousand over this range of temperature. In both of the other instruments the compensation was good between 10 deg. C. and 25 deg. C., but was less perfect between 25 deg. C. and 50 deg. C.

A certain degree of compensation can be provided without the use of compensating coils, by a proper choice of the materials used in the moving-coil circuit, control springs, shunt, &c. In one of the "uncompensated" foreign instruments the variation in sensitivity corresponded almost exactly to that found in the compensated instrument of foreign manufacture already referred to. Another uncompensated instrument, a British one, showed a temperature variation between 12 deg. C. and 30 deg. C., rather less than twice that of the compensated foreign instrument, the total variation in the uncompensated British instrument between 12 deg. C. and 50 deg. C. being only one-third of that of the compensated foreign instrument.

Internal Construction.

(a) *Zero Adjustments.*—In some of the instruments no zero adjustment of any kind was fitted, while in several others the fitting provided was very light and flimsy. In less than half the instruments was the zero adjustment really robust. Zero adjustments were fitted in all the British instruments.

(b) *Coil Mounting.*—In many instruments the coil was supported between bridge-pieces mounted on the pole-pieces in such a way that the movement could not be removed from between the pole-pieces without dismantling it. In other instruments the whole movement was held in a frame, either pressed or die-cast, which could be slipped from between the pole-pieces after one or two screws and connections had been loosened. The latter form of construction, which is adopted by most of the manufacturers whose instruments were examined, would appear for many reasons to possess advantages over the former.

In the instruments made by one foreign manufacturer the frame which carried the coil was of a very flimsy construction, and was held in position between the pole-pieces by shellac; this instrument was rather unusually constructed in almost all respects.

In the instruments made by two British manufacturers the

jewels were mounted on resilient supports. Two instruments, neither of which was provided with resilient supports, were found to be damaged when they were opened. The practice of fitting resilient supports to the jewels affords considerable protection to the movement against risk of damage.

Springs.

In all the instruments phosphor-bronze springs were used. All the instruments were tested to see if the zero changed temporarily or permanently after the coil had been kept deflected to about 90 per cent. of the maximum deflection possible, for periods up to 72 hours. In only two instruments was the zero unchanged after this period, though the change was only temporary.

The problem of making springs free from the defect in question has not yet been solved by any of the manufacturers whose instruments were examined. The "torque/weight" quotient varied very considerably, ranging between 0.044 and 0.46.

Magnetic System

The magnets used differed largely in weight, in cross section and in length: the magnet steels also differed considerably in their "coercive force." Of the instruments of normal design, those with the longest and shortest air gaps, respectively, had gap fields which differed by less than 10 per cent., *despite the fact that the magnet in the instrument with the long air gap weighed only half as much as the magnet in the other instrument*: the heavier magnet was 20 per cent. longer than the lighter magnet. The coercive force of the steel which was used in the instrument having the large air gap was some 30 per cent. higher than that of the magnet in the instrument which had the short air gap, and, in addition, the design of the system was such as to minimise the magnetic leakage round and over the gap. It will be seen, therefore, that an instrument cannot be adversely criticised merely because it has a somewhat large air gap. The larger gap greatly reduces the danger of the coil "sticking" if a particle of magnetic dust happens to get into the gap.

Pole-pieces.

Some of the instruments were open to serious criticism as regards the way in which the pole-pieces were supported. They should be mounted in such a way that no strain can be imposed on the movement by the means provided for fixing the pole-pieces in position. Such strain is not likely to arise if the movement is carried by a frame or casting which can be removed from the instrument without dismantling and without disturbing the pole-pieces. In some of the instruments the fit of the components was so bad that the strain thrown on the movement during assembly must have been considerable.

The movements of most of the British and foreign instruments were mounted in separate frames or castings so as to be independent of the mode of fixing the pole-pieces.

Magnetic Shielding.

The instruments were not tested to determine the extent to which their indications were affected by external magnetic fields. The Continental instruments examined were not so completely shielded as the British and American instruments.

External Appearance.

Experience gained during the examination of the instruments has led definitely to a conclusion which favours a type of finish almost severely plain, the only relief being such as would be afforded by a thin raised rim, either nickel-plated or black, the rest of the body having either a plain or unobtrusive matt ground, finished dead black or semi-dead black. The majority, though not all, of the British instruments examined were finished in styles corresponding to that for which preference has just been expressed.

Scales.

The types of scales which were considered to be the most satisfactory were fitted in certain of the British instruments. In two pairs of foreign instruments the scales were fairly satisfactory, though the figures in most of the foreign instruments were much less readily recognised than those in the British instruments just mentioned.

Pointers.

The pointer-heads varied in shape from that of a narrow spearhead to a pear-shape, some of the heads having circular holes punched in the middle. The best type of pointer for accuracy of reading was one of a modified diamond shape, all four sides of the diamond being concave, with the "reading" end of the pointer head very long and finely tapering, the extreme end being about the same width as the graduations of the scale.

Dials.—The dials were all graduated in black lines on a white background. Provided that the paint adheres properly to the metal plate and does not become discoloured or detached when the instrument is in service, the use of a painted dial would appear to be preferable to the fitting of a paper dial cemented to a metal back, though the whiter colour which can be obtained on a first-quality card is a point in favour of the use of card instead of painted metal. The best finished dials were found in the instruments made by certain British manufacturers.

General Statement.

The results of the examination are summed up as follows:—

(*a*) The best of the instruments examined, both British and foreign, are generally well suited to the purposes they are intended to serve, and none among them shows an outstanding superiority over all the others in every particular. Two pairs of instruments of British manufacture were open to criticism in respect of certain details of construction, while two pairs of instruments of foreign origin were distinctly inferior, both in design and construction, to any of the other instruments examined.

(*b*) If the instruments were placed in order of merit as assessed on some particular criterion of excellence, the instrument placed first would in many instances be a British one; certain of the British instruments examined would occupy high positions whatever criterion were chosen.

(*c*) The consistently high positions occupied by certain British instruments has led us to the definite conclusion that the best-known British instruments of the kind dealt with are quite equal to the best-known corresponding products of foreign origin, in the suitability of their design for the purpose to be served, in the consistency of their indications, and in the general lines and details of their construction.

Victoria Embankment Electric Lighting.

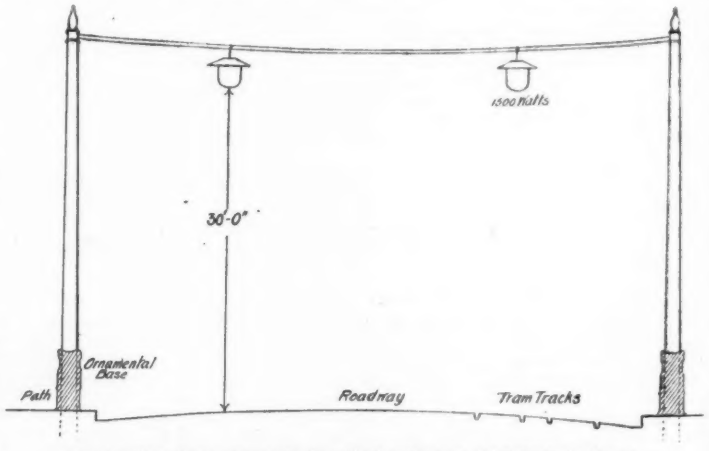
Particulars of the New Scheme.

THE London County Council, at a meeting on December 18th, approved a scheme for replacing the existing electric lighting arrangements of the Embankment with a completely new system.

The report of the Highways Committee, dealing with the matter, states that the Committee has had under consideration, for some time, the question of the steps to be taken to bring the artificial lighting of the Embankment up to the standard now thought necessary, having regard to the greatly increased and rapid traffic along this important highway.

The present installation was designed for series of arc lamps, and the energy was originally generated in the Council's own works; since 1910 the energy has been purchased from the public supply authorities. Gasfilled incandescent lamps were in due course substituted for arc lamps, and at present there are 63 kerb, 69 parapet, and 38 refuge standards, with some few additional fittings under the bridges.

The chief engineer has prepared the new scheme to bring the lighting into conformity with the B.E.S.A. specification for street lighting; both electric lighting and gas companies were invited to submit proposals on this scheme, which has as its main feature the suspension of the lamps over the centre of the road—as shown in the accompanying sketch.



Suspension Arrangements for Embankment Lighting Scheme.

After careful consideration the Committee decided to recommend the acceptance of the tender submitted by the Charing Cross Electric Supply Co., Ltd., at an inclusive cost of £14,184, which includes the provision of ornamental bases for the standards to carry the span wires across the carriageway.

These span wires will carry two 1,500-watt lamps, at a

height of 30 ft. above the roadway, and will be spaced 140 ft. between spans: the cables to supply this new system of lighting will be laid under the footways.

With regard to the use of centrally suspended lamps over the carriageway, the Highways Committee states that such lanterns were experimented with on the Embankment opposite Hungerford House some years ago, and were found to afford much improved illumination; the Committee is satisfied that this form of illumination is the best method of obtaining uniform and efficient results, and considers that the necessity for putting the lighting into a satisfactory condition justifies any small interference with the amenities of the Embankment that would be caused by the overhead span wires, which, however, at a height of 30 ft., will be inconspicuous.

The annual maintenance charges will be £3,700, exclusive of painting the columns and repairing any parapet lanterns.

The British Industries Fair.

A List of Electrical Exhibitors in the London Section.

THE catalogue of the London Section of the British Industries Fair is again out well in advance of the show, and we have been able to select from it about seventy exhibitors whose displays will be principally of electrical interest (including radio). In our issue of December 21st we printed a list of electrical and allied exhibitors at Birmingham. Ignoring one or two duplications, the Fair as a whole will include about 200 exhibitors of the class mentioned—a very fair showing. The London list follows:—

Accurate Recording Instrument Co., Ltd.
Ajax, Ltd.
Albion Shades, Ltd.
Atkinson, C. Creswick.
"Attracta" Electrical Co.
Axuel Time Switches, Ltd.
Bakelite, Ltd.
Beatty Bros., Ltd.
Belling & Lee, Ltd.
Berry's Electric, Ltd.
Beuttell, A. W., Ltd.
Birkbys, Ltd.
Bower Electric (1926), Ltd.
Brantford Washing Machine Co., Ltd.
Brook, J. A.
Brown, S. G., Ltd.
Brownie Wireless Co. of Gt. Britain, Ltd.
Burovox, Ltd.
Calvete, I., Ltd.
Celebritone, Ltd.
Clarke, H., & Co. (Manchester), Ltd.
Cole, E. K., Ltd.
Cossor, A. C., Ltd.
De La Rue, Thos., & Co., Ltd.
Dowsing Radiant Heat Co., Ltd.
Dubilier Condenser Co. (1925), Ltd.
Dyson, J., & Co., Ltd.
Eastick, J. J., & Sons.
Eastern Telegraph Co., Ltd.
Ever-Ready Co. (Gt. Britain), Ltd.
Federation of British Industries.
Ferranti, Ltd.
Formo Co.
Franco-British Electrical Co.
Fraser & Glass.
Freezone, Ltd.
Fuller Accumulator Co. (1926), Ltd.
Garnett, Whiteley & Co.
Graham, Farish, Ltd.
Hailwood & Ackroyd, Ltd.
Halcyon Wireless Co., Ltd.
Hoover, Ltd.
Ideal Home Electric Appliances, Ltd.
Igranic Electric Co., Ltd.
Johnson, Matthey & Co., Ltd.
Langham Radio.
Lever, Eric J., (Trix), Ltd.
Lissen, Ltd.
Loewe Radio Co., Ltd.
M-L Magneto Syndicate, Ltd.
"M.P.A." Wireless, Ltd.
Marathon, Ltd.
Marconi's Wireless Telegraph Co., Ltd.
Mullard Wireless Service Co., Ltd.
Neophone Engineering Co.
Nobbs, George, Ltd.
Northern Aluminium Co., Ltd.
Ormond Engineering Co., Ltd.
Power Engineering Co.
Read Radio, Ltd.
Rees, Mace Mfg. Co., Ltd.
Rialton Radio.
Selectors, Ltd.
Sheringham Daylight Co.
Solidite & Synthetic Mouldings, Ltd.
Spauldings, Ltd.
Telegraph Condenser Co., Ltd.
Thermega, Ltd.
Triotone, Ltd.
Truphonic, Ltd.
Watmel Wireless Co., Ltd.
Westinghouse Brake & Saxby Signal Co., Ltd.
Whittingham, Smith & Co.
Wright & Weaire, Ltd.
Wandle Radio Co.
Zone Wireless Co., Ltd.

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged and all subsequent proceedings will be taken.

1927.

15,169. "Means for driving television or other apparatus at a predetermined speed." J. L. Baird and Baird Television Development Co., Ltd. June 7th, 1927. (301,847.)

17,724. "System of selective remote control by superimposing alternating currents on linked light and power mains." O. Muck. July 4th, 1927. (Patent of addition not granted.) (301,939.)

17,884. "Ventilation of dynamo-electric machinery, transformers, and the like." Sir C. A. Parsons and J. Rosen. July 5th, 1927. (301,771.)

18,054. "Alternating current dynamo-electric machines." General Electric Co., Ltd., and M. Kahn. July 7th, 1927. (301,848.)

22,698. "Circuit arrangements for the operation of electric discharge tubes with direct current." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). August 29th, 1927. (301,763.)

23,093. "Transformer connections, for example, for rectifiers." British Thomson-Houston Co., Ltd., and J. C. Read. September 2nd, 1927. (301,767.)

23,162. "Control of the load factor in electrical current-supply systems to factory and similar installations, including electrical resistance furnaces." Birmingham Electric Furnaces, Ltd., and A. G. Lobley. September 3rd, 1927. (301,814.)

23,296. "Metallic-vapour rectifiers for alternating currents." Akt. Ges. Brown, Boveri et Cie. October 18th, 1926. (279,045.)

23,306. "Magnet cores." Automatic Telephone Manufacturing Co., Ltd., and P. N. Roseby. September 5th, 1927. (301,784.)

23,307. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. September 5th, 1927. (301,785.)

23,393. "Electric protective devices." British Thomson-Houston Co., Ltd., H. Trencham, and H. S. Petch. September 6th, 1927. (Addition to 268,485.) (301,948.)

23,436. "Valve rectifying and amplifying arrangements." Siemens and Halske Akt.-Ges. September 17th, 1926. (277,650.)

23,558. "Cathode-ray tubes." C. H. F. Muller Akt. Ges. September 7th, 1926. (277,347.)

23,640. "Arrangement for switching off an inductive resistance mounted in a direct current circuit." Siemens-Schuckertwerke Akt. Ges. September 11th, 1926. (277,356.)

23,648. "Automatic regulation of dynamo-electric machines." J. Stone and Co., Ltd., and A. E. Honey. September 8th, 1927. (301,953.)

23,672. "Electric induction furnaces." E. F. Northrup. September 8th, 1927. (301,954.)

23,851. "Loud-speaking telephones and the like." Sterling Telephone and Electric Co., Ltd. N. Blades, and J. R. Beard. September 10th, 1927. (301,960.)

24,799. "Electric motor-control systems." General Electric Co., Ltd., and H. G. McClean. September 21st, 1927. (301,977.)

24,860. "Insulating panels." Siemens Bros. & Co., Ltd., and W. E. Goodwin. September 21st, 1927. (301,979.)

25,046. "Electrical condenser units." Dubilier Condenser Co. (1925), Ltd. (W. Dubilier). September 22nd, 1927. (301,980.)

25,272. "Apparatus for testing motor road vehicles." F. W. Highfield and Highfield Electrical Co., Ltd. September 24th, 1927. (301,982.)

25,279. "Manually operated selecting switches for telephone and like systems." A. Graham & Co., Ltd., and A. C. Brockies. September 24th, 1927. (301,983.)

25,496. "Loud-speaking telephones." Sterling Telephone & Electric Co., Ltd., N. Blades, and J. R. Beard. September 27th, 1927. (301,989.)

25,634. "Systems of electric motor control." British Thomson-Houston Co., Ltd., and C. H. Hastings. September 28th, 1927. (301,991.)

27,062. "Arrangement in commutator machines connected in cascade to induction machines." Allmanna Svenska Elektriska Aktiebolaget. October 15th, 1926. (279,086.)

28,142. "Electric locomotives." H. P. Bramah and Metropolitan-Vickers Electrical Co., Ltd. October 22nd, 1927. (302,009.)

28,551. "Electrical plugs." T. Harden and H. A. Mepham. October 27th, 1927. (302,012.)

28,658. "High-voltage system and apparatus for use particularly with X-ray tubes." F. S. Smith. October 27th, 1927. (Convention date not granted.) (282,020.)

29,630. "Sound-reproducing apparatus." H. T. P. Gee (F. W. Paterson). November 5th, 1927. (302,022.)

29,714. "Electric circuit breakers." Electrical Improvements, Ltd., and L. C. Grant. November 7th, 1927. (302,024.)

29,899. "Electric contact breakers." British Thomson-Houston Co., Ltd., and E. G. Parrott. November 8th, 1927. (302,025.)

31,591. "Electric fuses and isolators." V. Hope. November 24th, 1927. (302,039.)

33,476. "Electric circuit breakers." A. B. Field, A. N. Hanworth, and Metropolitan-Vickers Electrical Co., Ltd. December 10th, 1927. (302,048.)

34,352. "Negative electrode for electric accumulators." A. Pouchain. December 20th, 1926. (282,449.)

34,641. "Arrangement for protecting stationary dry surface contact rectifiers from overload." Siemens-Schuckertwerke Akt. Ges. December 22nd, 1926. (282,693.)

35,222. "Clamps or connectors for electric cables." T. Yamanouchi. December 29th, 1927. (302,063.)

35,332. "Temperature-responsive devices." International General Electric Co., Inc. December 30th, 1926. (282,827.)

35,335. "Electrodes for use in arc welding." Imperial Chemical Industries, Ltd., and J. H. Paterson. December 30th, 1927. (302,064.)

1928.

131. "Thermo-electrically operated devices for the protection of rotary dynamo-electric machines." Electrical Improvements, Ltd., and H. B. Poynder. January 3rd, 1928. (302,066.)

1,064. "Couplings for electric conduits." J. Brighouse. January 12th, 1928. (302,068.)

1,584. "Air drying apparatus for oil-immersed electrical transformers." Allmanna Svenska Elektriska Aktiebolaget. January 4th, 1928. (302,071.)

1,828. "Automatic protection and control of electrical installations." S. Schild. February 24th, 1927. (285,870.)

10,750. "Motor train for operating switches." Landis & Gyr Soc. Anon. June 11th, 1927. (292,062.)

11,335. "Shadowless lighting apparatus." Anciens Etablissements Barbier, Benard & Turenne Soc. Anon. February 10th, 1928. (302,105.)

11,519. "Automatic electric cut-in and cut-out switches for battery charging systems." F. Whipp, Whipp & Bourne, Ltd., and Mather and Platt, Ltd. April 19th, 1928. (302,107.)

12,355. "Valve amplifying device combined with a reproducing apparatus for sound films." H. J. Kuchenmeister. November 2nd, 1926. (Divided application on 28,323/27.) (289,448.)

12,367. "Electric sign." J. E. Long. April 27th, 1928. (302,109.)

12,562. "Planet gear drive for electro-mechanical phonographs." W. Rebikoff. September 10th, 1927. (296,975.)

14,744. "Leads for sounding purposes." Electroacustic Ges. June 2nd, 1927. (291,444.)

16,583. "Alternating current motors with short-circuited armatures." Bergmann Elektricitätswerke Akt Ges. June 11th, 1927. (292,071.)

18,195. "Incandescent electric lamps and the like." C. Tourne. June 23rd, 1927. (Addition to 273,293 and 280,496.) (292,616.)

18,660. "Electrically-driven roller ways." B. Quast and F. Lomberg. January 25th, 1928. (302,128.)

19,621. "Resistance elements for electric fires and the like." G. Pate and J. R. Laird. July 6th, 1928. (302,130.)

24,663. "Submersible electric machines." Siemens-Schuckertwerke Akt. Ges. October 20th, 1927. (299,035.)

27,039. "Coupling arrangements for use in high frequency circuits." Marconi's Wireless Telegraph Co., Ltd. September 21st, 1927. (297,434.)

32,126. "Electric control switch constructions." F. Berg. August 6th, 1927. (Divided application on 300,152.) (301,964.)

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ANNAN.—Extensions to Academy (£4,625), for Dumfries-shire E.C.; director of education, Dumfries.

ASHFORD.—Hostel at County School for Girls; Kent Education Committee.

AYRSHIRE.—Entertainment pavilion (£7,000) for Largs Town Council; burgh surveyor.

BARNSLEY.—Development of building estate at Lees Hill, Ardsley; J. K. Micklewait.

BINGLEY.—Housing scheme (24); E. O. Robinson, architect, Town Hall.

BIRKENHEAD.—Extensions, Isolation Hospital; borough engineer. Six wards and sun room, Red Cross Hospital, Manor Hill; governors. Extensions, Maternity Hospital; borough engineer. Shops and houses, Town Lane and Larchwood Drive; Thomas Evans & Co., Rock Ferry.

BRIDLINGTON.—Housing scheme (60), for the T.C.; borough surveyor.

BROMLEY (KENT).—Houses (71), Palace Estate, for H. F. Thoburn.

BURSLEM.—Extensions, Royal Staffs. Pottery Market Place; J. Steventon & Sons. Warehouse, Portland Tile Works, Portland Street; E. Roddy.

CADISHEAD.—School, for Lancs. E.C.; director of education, Preston.

CALNE.—Electric light installation, Town Hall, for the T.C.; borough surveyor.

CARLISLE.—Cinema, Caldewgate, for W. Williams, Workington.

CASTLEFORD.—Electric light installation, Barnes Road Maternity Home, for the U.D.C.; Fred Scatchard, architect, Midland Bank Chambers.

CHESHUNT.—Houses (30), Dewhurst Road, for W. B. Hart.

COLCHESTER.—Housing scheme (60), for the T.C.; Harold Collins, borough engineer.

CROYDON.—Shops and houses, Mitcham Road Housing Estate, for the T.C.; borough surveyor. Reconstruction of baths (£24,000), with electrical work, for the T.C.; borough engineer.

DERBY.—Block of offices for Derbyshire C.C.; G. H. Widdows and G. C. Copestick, architects, St. Mary's Gate (returnable deposit of £1 1s.).

DOUGLAS (ISLE OF MAN).—Additional 100 houses for the T.C.; borough surveyor.

DOVER.—Cinema, for the Dover Theatre Syndicate, 50, Sloane Square, London.

DUDLEY.—500 houses, Priory Estate; borough engineer. Four schools for the Borough E.C.; director of education.

DUNDEE.—Housing scheme (400); city engineer.

EDINBURGH.—Radium Institute (£40,000); secretary, Board of Management, Royal Infirmary.

FALKIRK.—Reconstructing old Falkirk High School to be used as mining centre; clerk, Stirlingshire Education Authority, Stirling.

FENTON.—Housing scheme, Evelyn Street and Marlborough Street; Stoke-on-Trent city engineer. 28 houses, Evelyn Street; Ball & Robinson, Stoke-on-Trent.

FLEETWOOD.—Pavilion, offices, &c., for the U.D.C.; surveyor.

FORT WILLIAM.—School; clerk, Local School Management Committee.

GLASGOW.—Battery house at Port Dundas, for Central Electricity Board; the engineer. Hall at Stirling Road for Salvation Army; officer in command, Salvation Army. School clinic at Springburn for Education Authority; clerk, Education Offices, Bath Street. Warehouse in Hutcheson Street and Garthland Street for John Glen and Co., Ltd., Ingram Street; the manager.

HAMPSHIRE.—Extensions, Park Prewitt Hospital, and nurses' home, Knowle Mental Hospital; Joint Mental Hospital Committee.

HANLEY.—Motor body works for Fishers (Hanley), Ltd., Vale Place; Cotton, Son & Hulme, architects.

HASSOCKS (SUSSEX).—Church; R. Hodgson, architect.

HAWARDEN.—Offices for the R.D.C.; J. H. Davies & Sons, architects, 14, Newgate Street, Chester (returnable deposit of £2 2s.).

HEREFORD.—Public baths for the T.C.; city surveyor (returnable deposit of £2 2s.); extensions, High School, for Herefordshire E.C.; county architect.

HITCHIN.—Additional 50 houses, for the U.D.C.; surveyor.

HUDDERSFIELD.—Public baths, &c., with electrical work, for the T.C.; L. Smith, borough architect, 26, Ramsden Street (January 14th).

HULL.—Two citadels on housing estates; Salvation Army. United Methodist Church, West Hull Estate; Rev. W. Woodhouse.

KEIGHLEY.—Probable reinstatement (after fire) of Trinity Works, for Smith Peace (Keighley), Ltd., engineers.

KIDDERMINSTER.—Works extensions, Anchorfields, for Morris & Co. Fire station (£3,65-), for the T.C.; Eridgwater Bros., builders, Cradley Heath.

LEIGH.—School, Manchester Road; director of education.

LONDON (ILFORD, E.).—Cinema, Green Lane; Lewis Solomon and Son. Extensions, Maternity Hospital; Medical Officer of Health. 117 houses, Inglehurst Gardens and Danehurst Gardens; Peachey & Co., Ltd. 67 houses, Chadwell Heath Lane and Herbert Road; A. Furridge and Co. 113 houses, Clifton Road and Malford Gardens; T. B. Goodwin. 35 houses, Park View Gardens and Grangeway Gardens; T. Anders. 88 houses, Perth Road and Middleton Gardens; J. Aldridge. 32 houses, Collingwood Gardens; A. Smith.

(POPLAR, E.).—Wharf additions, West Ferry Road; Aston Grant & Co., Ltd.

(CLAPHAM, S.W.).—Warehouse, Park Hill; Wilton Decorators, Ltd.

(STREATHAM, S.W.).—42 houses, Leigham Court Road and Romeyn Road; F. T. Wooding & Sons.

(WALWORTH, S.E.).—Tenements, Peresford Street; Church Army Housing, Ltd.

MACCLESFIELD.—Silk mill extensions, Chester Road, Poynton, for William Booth, Ltd.

MAIDSTONE.—Extensions, West Kent General Hospital (£50,000); secretary.

MANSFIELD.—School, for the Borough E.C.; borough surveyor.

MERTON AND MORDEN.—School (£20,780), for Surrey E.C.; A. Monk, builder.

MORECAMBE.—Alterations, Morecambe Tower; Denman Picture Houses, Ltd.

NEWCASTLE-UPON-TYNE.—School, High Heaton Estate; City Education Committee.

OXFORD.—Church (£4,500), for Cowley Congregational Trustees; H. W. Smith, architect, George Street.

PENWORTHAM (PRESTON).—Church, Congregational trustees. Fire station (£4,300), for Preston R.D.C.; W. Beetham & Co., builders.

PONTEFRACT.—Colliery developments, Prince of Wales Pit, for Pontefract Collieries, Ltd.

PORTERS PARK.—First section, Mental Hospital (£43,661); John Laing & Son, Ltd., Mill Hill, for Middlesex C.C.

RICHMOND (SURREY).—Re-wiring 15 circuits for electric light, Infirmary, dining hall, and laundry blocks, for the B.G.; Brewer, Smith & Brewer, architects.

SHIPLEY.—New public offices; U.D.C. Special Committee.

STOCKPORT.—Extensions to Infirmary (50 beds), for the governors; Worthington & Son, architects.

SWANSEA.—Industrial centres for mental defectives; Education Committee.

SWINDON (WILTS.).—Educational hall and bakery extensions, for the New Swindon Industrial Co-operative Society, Ltd.; secretary.

WAKEFIELD.—Municipal office extensions; city engineer.

WALSALL.—Additional 450 houses for the T.C.; borough surveyor.

WARRINGTON.—Sunday schools and church hall (£4,500), for St. John's Presbyterian Church; secretary.

WATFORD.—Factory, Bye-Pass Road, for National Filling Factory, Coventry; F. H. Clark.

WELWYN (HERTS.).—Additional 30 houses, for the R.D.C.; surveyor.

WESTON-SUPER-MARE.—Additional 111 houses for the U.D.C.; surveyor.

WILLINGTON (CO. DURHAM).—Additional 30 houses for the U.D.C.; surveyor.

WREXHAM.—Additional 36 houses, Huntroyde Estate, for the T.C.; John England, borough surveyor.